(28,237)

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1921.

No. 302.

SNAKE CREEK MINING AND TUNNEL COMPANY, PETITIONER,

vs.

MIDWAY IRRIGATION COMPANY AND WILFORD VAN WAGENEN.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE EIGHTH CIRCUIT.

INDEX.

JUDD & DETWEILER (INC.), PRINTERS, WASHINGTON, D. C., SEPTEMBER 15, 1921.

a Pleas and proceedings in the United States Circuit Court of Appeals for the Eighth Circuit, at the December Term, 1920, of said Court, before the Honorable Walter H. Sanborn and the Honorable Kimbrough Stone, Circuit Judges, and the Honorable Jacob Trieber, District Judge.

Attest:

[Seal of the United States Circuit Court of Appeals, Eighth Circuit.]

E. E. KOCH,
Clerk of the United States Circuit Court of Appeals for the Eighth Circuit.

Be it Remembered that heretofore, to-wit: on the first day of March, A. D. 1920, a transcript of record pursuant to an appeal allowed by the District Court of the United States for the District of Utah, was filed in the office of the Clerk of the United States Circuit Court of Appeals for the Eighth Circuit in a certain cause wherein Midway Irrigation Company, et al., were Appellants, and Snake Creek Mining and Tunnel Company was Appellee, which said transcript as prepared and printed in pursuance of the designation of appellants and the stipulation of the parties for the use of the Court upon the hearing of said cause, under the rules of the United States Circuit Court of Appeals for the Eighth Circuit, under the supervision of its Clerk, is in the words and figures following, to-wit:

1 United States of America,
District of Utah, ss:

At a Regular Stated Term of the District Court of the United States for the District of Utah, in the Central Division Thereof, Begun and Held in the Court-room, in the Federal Building, at Salt Lake City, on the 11th Day of November, in the Year of Our Lord Nineteen Hundred and Eighteen and the One Hundred and Forty-second Year of the Independence of the United States of America.

Present: Honorable Tillman D. Johnson, United States District Judge for the District of Utah.

Transcript of the Record.

(Bill of Complaint.)

In Equity.

No. 3717.

Snake Creek Mining and Tunnel Company, a Corporation, Plaintiff,

vs.

Midway Irrigation Company, a Corporation, and Wilford Van Wagonen, Defendants.

The plaintiff states:

1st. That it is a corporation organized and existing under the laws of the State of Delaware and a citizen and resident thereof; that the defendant, Midway Irrigation Company, is a corporation of the State of Utah and a citizen and resident thereof; and the defendant, Wilford Van Wagonen, is a citizen and resident of the State of Utah.

2nd. That the plaintiff in the month of April, 1910, and prior thereto was, and has ever since continued to be the owner and in the possession of the following described real estate situate in Wasatch County, State of Utah, to-wit: The northeast quarter (¼) of section eighteen (18), township three (3) south, range four (4) east of Salt Lake Meridian.

2 3rd. That in the month of April, 1910, it commenced to drive and construct a tunnel the portal of which is on said real estate and has driven and constructed said tunnel in a northwesterly direction from said portal for a distance of 14,500 feet into the mountain at great depth, and is the owner and entitled to and in the possession of said tunnel and the water issuing therefrom.

4th. That in the prosecution of the work of driving said tunnel into the mountain at the distance of about 2,684 feet from the portal of the tunnel, water was encountered, percolating through the rocks, soil and gravel through which the tunnel was being driven, and which water issues from the sides and other surfaces of the tunnel, and which accumulates therein, and is conveyed through and from the tunnel in a sluice at the bottom of the tunnel, the amount of water flowing from the tunnel on May 22, 1918, being 14.38 second feet, or 6,454 gallons per minute.

5th. That from the portal of the tunnel the water therefrom flows a distance of about 2,000 feet into Snake Creek, which is a tributary of Provo River.

6th. That Snake Creek, Spring Creek and Provo River are natural and public water courses and streams, and the water flowing from

the tunnel into Snake Creek unless intercepted and diverted would flow down Snake Creek into Spring Creek and down Spring Creek into Provo River and from Provo River into Utah Lake, less the amount lost by seepage with evaporation.

7th. That water was first encountered in the tunnel about the month of January, 1911, and has been increasing in quantity ever since, as the work of driving the tunnel progresses, unto the present time, and the water now flowing from the tunnel is of great value for the purposes of developing power, for irrigation, domestic and other useful and beneficial purposes.

8th. That in permitting the water from the tunnel to flow into Snake Creek, the plaintiff did not intend to abandon its title or right to said water or to the use thereof, and did not intend that the water flowing from the tunnel into Snake Creek should become or be a part of the waters of Snake Creek, Spring Creek or Provo River, subject to appropriation and use by others, but on the contrary always claimed to own said water flowing from the tunnel into Snake Creek, with the right to take and divert from any of said streams for irrigation or any other useful and beneficial purposes an amount
3 of water equal to the amount flowing from the tunnel, less the amount lost by seepage and evaporation between the portal of the tunnel and the point of diversion, and has ever since there has been enough water flowing from the tunnel to make it valuable therefor, diverted or caused to be diverted from said streams for the development of power and for irrigation an amount of water equal to the amount flowing from the tunnel, less the amount lost by seepage and evaporation between the portal of the tunnel and the point of diversion.

9th. That the plaintiff prior to the commencement of the irrigating season of the year 1914, sold, conveyed and transferred to the Provo Reservoir Company, a corporation of Utah, organized to furnish water to it stockholders and others, for the purposes of irrigation, the right to take from Provo River for the purpose of irrigation by its stockholders during the irrigating season of the year 1914, its right to the water flowing from the tunnel and the right to divert and take from Provo River an amount of water equal to the amount flowing from the tunnel, less loss by seepage and evaporation, between the portal of the tunnel and the point of diversion.

10th. That the water flowing from said tunnel, less the loss by seepage and evaporation, is necessary to the said Provo Reservoir Company and its stockholders for the growing of their crops and other vegetation during the growing season of 1914, and without said water the crops of many of the stockholders of said Reservoir Company will be greatly injured and diminished in value, if not destroyed.

11th. That the said Reservoir Company, to which the plaintiff has sold, conveyed and transferred its right to take and divert from Provo River for the purposes of irrigation, the water flowing from

the tunnel, less loss by seepage and evaporation, has the right to take said water from the Provo River for the purposes of irrigation without let or hindrance by any person or corporation on Provo River or any of its said tributaries.

12th. That all the waters of Snake Creek, Spring Creek and Provo River, other than the water flowing into Snake Creek from the tunnel as hereinbefore set forth, have been heretofore appropriated and used for irrigation and other useful and beneficial purposes.

13th. That the defendant Midway Irrigation Company is a corporation organized to furnish water to its stockholders for the
4 purpose of irrigation and the defendant Wilford Van Wagonen is the president and manger thereof.

14th. That the defendant Midway Irrigation Company and the defendant Wilford Van Wagonen as president and manager thereof claim that the plaintiff is not the owner of the water flowing from said tunnel and that it has no interest therein, and denies that the plaintiff or said Provo Reservoir Company as the purchaser from the Plaintiff as aforesaid has the right to take any water from said Provo River or from any of its said tributaries by reason of the flow of water from said tunnel as aforesaid, and claim, as the plaintiff is informed and believes, that the water flowing from said tunnel into Snake Creek as aforesaid was the subject of appropriation and use by others and that the defendant Midway Irrigation Company has appropriated all the waters of Snake Creek between the point where the water from the tunnel flows into Snake Creek and the places below on Snake Creek where the said Midway Irrigation Company diverts the water of Snake Creek for the purposes of irrigation and other purposes and has the right to divert all the water flowing from the tunnel from said Snake Creek for the purposes of irrigation and other purposes.

15th. That said defendants for sometime immediately preceding the 6th day of July, 1914, have diverted or caused to be diverted at different places on said Snake Creek below where the water from the tunnel flows into Snake Creek all the water flowing from said tunnel and have thereby deprived said Provo Reservoir Company and its stockholders of the use of said water and of any water from said Provo River by reason of the water flowing from said tunnel, and by reason thereof the crops of said Provo Reservoir Company and of its stockholders have suffered and are suffering from want of sufficient water and the defendants threaten to continue to divert all of the water flowing from the tunnel into Snake Creek and use it for the purpose of irrigating the crops of said Midway Irrigation Company and of its stockholders. That such action on the part of the defendants, if continued, will deprive said Provo Reservoir Company and its stockholders of sufficient water for their crops, including grain, alfalfa and fruit crops and will cause them great damage and irreparable loss and injury.

15th. That the claims of the defendants that the plaintiff is not the owner of the water flowing from the tunnel into said Snake Creek and that when the water from the tunnel flowed into said Snake [—] it became a part of the public waters of said
5 stream and subject to appropriation and use by others as
against the defendant and said Provo Reservoir Company and that the plaintiff has no right to have the water flowing from the tunnel into said Snake Creek flow down said Snake Creek into said Spring Creek and from it into said Provo River and the claim of the defendants that the plaintiff has no right to take or divert any water from any of said streams because of the water flowing from the tunnel into said Snake Creek, and the claim of the defendants that said Midway Irrigation Company and not the plaintiff has the right to divert all the waters from said Snake Creek including the water flowing from the tunnel, and use the same for the irrigation of its lands and that of its stockholders, is without right and adverse to the rights of the plaintiff as hereinbefore set forth.

16th. That the loss by seepage and evaporation in the water flowing from the tunnel, between the portal of the tunnel and the point of diversion furthest down Snake Creek through which water is diverted from Snake Creek by the defendants does not exceed five per cent, leaving in said Snake Creek at that point a flow of 6,132 gallons a minute from the water flowing from the tunnel.

17th. That the plaintiff has no adequate remedy at law and only in a court of equity.

Wherefore the plaintiff prays that a subpœna issue herein requiring the defendants to appear and answer to this bill of complaint, that they be required to set up what right, title or interest they or either of them claim to have in and to the water flowing from said tunnel, or all the water flowing therein from said Snake Creek, and that the plaintiff's right, title and interest in and to the water flowing from said tunnel and the right of the plaintiff, by itself, its agents, lessees and grantees to take and divert an amount of water from said streams equal to the amount flowing from said tunnel, less loss by seepage and evaporation between the portal of the tunnel and the point of diversion, be established and confirmed as against the defendants and all persons claiming by, through or under them or either of them, and that it be decreed that neither of the defendants has any right to take and divert from said Snake Creek below the point where the water issuing from said tunnel flows into said Snake Creek, all the water thereof, or an amount of water that will not leave in said water course an amount of water equal to the amount flowing from the said tunnel, less loss by seepage and evaporation, and the plaintiff further prays that until the hearing hereof the defendants be restrained by order of this Court from tak-
6 ing and diverting from said Snake Creek, below the point
where the water from the tunnel flows into said Snake Creek, any amount of water that will not leave in the bed of the stream at the lowest point on said Snake Creek where the defendants divert

water from said Snake Creek, a flow of water equal to 6,132 gallons per minute, and the plaintiff prays for such other and further relief as shall be equitable.

(Signed) ANDREW HOWAT,
H. R. MACMILLAN,
FRANK K. NEBEKER,
Solicitors for Plaintiff.

STATE OF UTAH,
County of Salt Lake, ss:

G. W. Lambourne, being first duly sworn, deposes and says: That he is an officer of the Snake Creek Mining & Tunnel Company, the plaintiff above named, to-wit, the secretary and treasurer thereof, and as such officer makes this verification for and on behalf of said plaintiff; that he has read the foregoing bill and knows the contents thereof and the same is true to his own knowledge, except the matters therein stated upon information and belief, and as to such matters he believes it to be true.

G. W. LAMBOURNE.

Subscribed and sworn to before me this 6th day of July, 1914.
[SEAL.] (Signed) N. W. BEST,
Notary Public.

My commission expires August 14, 1916.

Endorsed: Filed in the District Court on July 6,1914.

Answer and Counterclaim.

Comes now the defendants in the above entitled cause and answering plaintiff's bill in equity filed herein, state:

1. That they admit the corporate existence of plaintiff and the citizenship and residence of the parties as alleged in the first paragraph of said bill.

2. That they admit the ownership of the lands as alleged and described in the second paragraph of said bill.

3. That they admit the commencement of the construction of a tunnel *on* or about the month of April, 1910, through said
7 land and that the same has been driven into the mountain a distance of substantially 8,000 feet up to the present time and that plaintiff is the owner and entitled to the possession of said tunnel, but they deny that plaintiff is the owner of or entitled to the use or possession of the water issuing from said tunnel as alleged in the third paragraph of said bill, or at all.

4. That they admit that in the prosecution of the work of digging said tunnel into the mountain a distance of about 2,684 feet and at other feet and other distances from the portal of the tunnel, water was encountered flowing through the rocks, soil and gravel through which the tunnel was being driven and

that water continues to flow through the rocks, soil and gravel from the sides and other surfaces and accumulates therein and is conveyed through and from the tunnel in a sluice at the bottom of the tunnel and flows out of the mouth thereof as alleged in the fourth paragraph of said bill, but it denies that the said waters entering said tunnel are percolating waters in the sense that the same are part of the soil lying therein without apparent movement, but on the contrary they allege that said waters before they enter said tunnel are flowing waters directly tributary to and a part of a natural stream of water known as Snake Creek and as to whether or not the volume of water flowing from said tunnel at the time of the filing of the bill of plaintiff was 9.6 second feet or 4,320 gallons per minute, these defendants have no knowledge or information sufficient to form a belief and they allege that the volume flowing from said tunnel is not a constant volume but on the contrary is a fluctuating volume varying one time with another in the same season and varying in quantity one season with another in proportion as the waters of Snake Creek vary in volume at different times in the same season and one year with another.

5. That they admit that from the portal of said tunnel the water issuing therefrom flows a distance of about two thousand feet into Snake Creek which is a tributary to Provo River.

6. That they admit that Snake Creek, Spring Creek and Provo river are natural water course and streams and that the water flowing from the tunnel into Snake Creek, unless intercepted and diverted, would flow down Snake creek into Spring creek, and down Spring Creek into Provo river and from Provo river into Utah Lake less the amount lost by seepage and evaporation as alleged in the [sieth] paragraph of said bill, but they deny that said Snake
8 creek, Spring creek or the Provo river are public water courses
and streams but on the contrary they allege that at the time plaintiff commenced the driving of said tunnel and for many years prior thereto all the waters flowing in said Snake creek or Spring creek or the Provo river had ceased to be public waters and had become vested in private ownership and said creeks or river had ceased to be public water courses or public streams.

7. That they admit that the water now flowing from said tunnel is of great value for the purposes of developing power, for irrigation, domestic and other uses and beneficial purposes and that water was first encountered in said tunnel about the month of January, 1911, and that the quantity flowing in said tunnel has since increased in quantity, but they deny that the quantity of water flowing from said tunnel has increased in quantity ever since or at all as the work of the tunnel progresses until the present time, with any regularity or in any proportion to the length of the tunnel, but on the contrary they allege that at different points in said tunnel flowing streams of water were encountered and as these streams were cut the quantity of water flowing into said tunnel was increased in volume.

8. That they admit that at divers times plaintiff has claimed to own the water and the right to use the same flowing from said tunnel, but as to what plaintiff's intent was these defendants have no knowledge or information sufficient to form a belief, but they allege that any intent on the part of plaintiff to at any time or place divert any of the flowing waters of Snake Creek on the part of plaintiff was wrongful and without right and they deny that at any time since the commencement of the construction of said tunnel there *has* been any waters flowing in Snake creek including the waters from said tunnel, that were subject to appropriation or use by plaintiff or any person or persons whatsoever, except the defendants in this action. They admit that during the year 1913 the lessee of plaintiff used a portion of the waters that flowed down Snake Creek into the Provo river, but they deny that ever since there has been enough water flowing from the tunnel to make it valuable or at any time whatever or at all, except as above stated plaintiff has diverted or caused to be diverted from said stream an amount of water equal to the amount flowing from the tunnel, less the amount lost by seepage and evaporation.

9 9. As to whether or not prior to the commencement of the irrigation season of 1914 plaintiff sold, conveyed and transferred to the Provo Reservoir Company for the purpose of irrigation the right to take from Provo river for the purpose of irrigation by its stockholders during the irrigation season of the year 1914 its right to the water flowing from the tunnel and the right to take from Provo river an amount of water equal to the amount flowing from the tunnel less loss by seepage and evaporation, these defendants have no knowledge or information sufficient to form a belief. That these defendants allege that if any such sale or transfer was attempted to be made that the same was void and of no effect for the reason that plaintiff had no ownership of the right to the use of any of the waters flowing in said Snake Creek and thence into the Provo River a subject of transfer or assignment.

10. That they deny that the water flowing from said tunnel is necessary to the Provo Reservoir Company or its stockholders for the growing of their crops or other vegetation during the growing season of 1914 or the growing season of any year or during any season in any year and deny that without said water the crops of many or any of the stockholders of said reservoir company or its stockholders will be greatly or at all injured or diminished in value or destroyed.

11. These defendants deny that the said reservoir company has the right or any right to take said water or any water flowing down Snake creek from the Provo river for the purpose of irrigation or for any other purpose. Whether or not under the purported authority of the plaintiff herein or under any authority or right whatever.

12. That they deny that the waters flowing into Snake Creek from the said tunnel have not been heretofore appropriated but on

the contrary allege that all of the waters flowing into Snake creek from said tunnel have for move than twenty-five years last past been appropriated and used by the defendants in this action and further allege that the defendants are now the owners thereof and of the right to the use of the same and as thus qualified the defendants admit that all the flowing waters of Snake Creek, Spring creek and the Provo river have been heretofore appropriated and used for irrigation and other beneficial and useful purposes.

13. That they admit that the Midway Irrigation Company
10 is a corporation and Wilford Van Wagonen is the president thereof as alleged in the thirteenth paragraph of plaintiff's bill.

14. That they admit that the defendants and each of them claim assert that plaintiff is not the owner of the water flowing from said tunnel and that it has no interest therein and that they deny that the plaintiff or said Provo Reservoir Company as purchaser from the plaintiff as aforesaid, or otherwise, has the right to take any water whatever from said Provo river or from any of its said tributaries by reason of the flow of water from said tunnel as aforesaid and claim and assert that the water flowing through said tunnel has been appropriated by the Midway Irrigation Company and that the said company has appropriated all the waters of Snake creek, not only between the point where the water from said tunnel flows into Snake Creek and the places below on Snake creek where said company diverts water thereform for the purpose of irrigation and other purposes, but also at the head waters and sources of said creek down to said places of diversion and use and admit that more than twenty-five years last past that it claims and asserts that it has, and has had the right to divert all the waters flowing down Snake creek past the mouth of the tunnel for the purposes of irrigation and other purposes and the waters it has diverted have been waters that have always found their way into Snake creek at various sources, but now find their way into said creek through said tunnel, but defendants deny that they claim a right to the use of said water by appropriation since the driving of said tunnel and they deny that any waters have been added to said creek by the driving of said tunnel which have been or are the subject of sale or appropriation or use by any persons whomsoever except the defendants in this action.

15. Defendants admit that for some time immediately preceding the 6th day of July 1914 they have diverted or caused to be diverted at different places on Snake Creek, below where the water from the tunnel flows into Snake Creek, all the water flowing from said tunnel, but they deny each and every other allegation contained in the fifteenth paragraph of plaintiff's bill and deny specifically that by reason of their diversion of water of Snake Creek as alleged in said paragraph they have reprived plaintiff or the Provo Reservior Company or any other person of water which said persons are the owners of the right to the use.

16, Defendants deny that their claim that plaintiff is not the

owner of the water flowing from said tunnel into Snake creek,
11 or that their claim that when the water from the tunnel
flowed into Snake creek that plaintiff has no right to have said waters flow down into Spring creek and thence into the Provo river, or that the plaintiff has no right to take or to divert any water from said stream because of water from said tunnel flowing into Snake creek, or, that their claim that the said Midway Irrigation Company and not the plaintiff has the right to divert all the waters from Snake Creek including the waters from the tunnel for the irrigation of the lands of its stockholders, is without right or adverse to the rights of the plaintiff as set forth in said bill or otherwise and they deny that plaintiff or its pretended transferee have any rights of ownership or use in or to the waters of said Snake creek whether flowing from said tunnel or which otherwise find their way into said creek. Defendants deny that they or their predecessors in interest at any time or at all, within the past twenty-five years, ever claimed or asserted that the waters flowing from said tunnel were public waters or subject to appropriation but on the contrary they allege that all of said waters which have found their way into Snake Creek from any source whatever including those which have flowed from the tunnel since construction thereof was commenced, have been appropriated by the defendant the Midway Irrigation Company for more than twenty-five years last past.

17. Answering the seventeenth paragraph of said bill defendants allege that they have no knowledge or information sufficient to form a belief as to the amount of loss by seepage and evaporation or the permanent flow of water at the mouth of the tunnel, less seepage and percolation as alleged in plaintiff's bill.

18. Defendants deny that plaintiff has no adequate remedy at law for the redress of any claims or wrong committed or alleged to have been committed by these defendants.

Further answering said bill and for affirmative relief and by way of counterclaim defendants affirmatively allege:

1. That the plaintiff, Snake Creek Mining and Tunnel Company is a corporation organized and existing under the laws of the State of Deleware and a citizen and resident thereof and that the defendant, Midway Irrigation Company is a corporation of the state of Utah and is a citizen and resident thereof and that the defendant, Wilford Van Wagonen, is a citizen and resident of the State of Utah.

2. That for more than twenty-five years next preceding the
commencement of this action, these defendants and their
12 grantors and predecessors in interest have been and these
defendants are now the owners of all the waters and water rights for irrigation, domestic and other beneficial purposes of the flowing waters of what is known as Snake Creek in Wasatch county, State of Utah, and that they became such owners by appropriation and diversion of said waters from Snake creek and the application

of the same to beneficial uses, to-wit, for irrigation, domestic and culinary purposes.

3. That said creek rises on the eastern slope of the Wasatch range of mountains west of what is known as "Provo Valley" in said Wasatch county and flows easterly towards and into said valley where said waters are now and during all the times herein mentioned have been used by the aforesaid owners thereof for the purposes hereinbefore mentioned.

4. That the natural sources of said creek consist of rain, melting snow, springs and seepages and before the construction of tunnels in the canyon through which said Snake creek flows during the spring, fall and summer months of each year said springs and seepages ordinarily supplied by far the greater portion of the flowing waters of said creek and were the main reliance of the defendants for the supply of water of Snake creek for the irrigation of their lands, for their domestic and other beneficial purposes.

5. That said springs and seepages had their source in the bosom of the mountains on which they were [situate] and before they were interecfered with by the tunnel of plaintiff and the tunnel of the Mountain Lake Mining Company, found their way to the surface of said mountains on the eastern slope thereof through natural channels and fissures in the rock imbedded in said mountains and thereby reached the surface and found their way into said creek and were the natural tributaries and feeders thereof.

6. That all the waters of said creek as above described and the water rights pertaining thereto are, as above stated, owned by these defendants and the same are necessary and not more than sufficient when economically used for the purposes hereinbefore stated.

7. That on or about the month of April, 1910, wrongfully and in violation of the rights of these defendants plaintiff commenced to drive and construct a tunnel into the mountains and has driven the same therein for a distance of substantially 8,000 feet and from the mounth of which a substantial quantity of water flows
13 sufficient- to irrigate several hundred acres of land and which
said waters formerly found their way into the natural [*natural*] surface channel of Snake Creek through underground channels and sources. That the tunnel constructed and excavated by plaintiff as described in its bill, is driven into the mountain in the immediate vicinity of said creek, its portal being in the canyon through which said creek flows and the waters from which mountains form the principal source of the supply of flowing water of said creek and in the prosecution of the work of making said tunnel the plaintiff undermined, cut off and diverted the underground flowing streams, springs and seepages constituting the permanent source of supply of the waters of said creek and thereby caused said waters to flow into and out of said tunnel from whence they emptied into and were restored to said creek. That by said undermining, interception cutting off and diverting the waters aforesaid as above de-

scribed, the said springs and seepages and streams were prevented from reaching the surface of the ground through the natural channels heretofore described as they theretofore had done, whereby and by means whereof said springs and streams ceased to flow through their natural orifices and thence into said creek as they had done theretofore but on the contrary were by the means aforesaid diverted away and caused to flow into and through said tunnel out of the mouth thereof as hereinbefore stated.

8. That said plaintiff in violation of the rights of these defendants in and to the use of said water now unlawfully claim a portion thereof, but said claim is adverse to the rights of these defendants as above set forth and is [unconscienable], inequitable and without foundation of right.

9. That prior to the digging of the tunnel described in plaintiff's bill and hereinbefore referred to, a corporation, to wit, the Mountain Lake Mining Company dug a deep tunnel into the mountain at a point higher up the stream and higher in elevation than plaintiff's tunnel and plaintiff's tunnel between its portal and the Mountain Lake tunnel crosses said Snake Creek underneath the bed of the said stream and is driven underneath or substantially underneath the said tunnel drive by said Mountain Lake Mining Company. That the driving of the Mountain Lake Company's tunnel dried up the springs which theretofore had come to the surface and which when the head of Snake creek canyon was bare of snow constituted the headwaters of Snake Creek, and thereafter and ever since the waters which formerly came to the surface through said
14 springs thereafter flowed out of the mouth of the said Mountain Lake tunnel. That since the driving of plaintiff's tunnel by plaintiff the volume of water flowing out of said Mountain Lake tunnel has receded to substantially one-third of the volume that flowed therefrom before the construction of plaintiff's tunnel and the greater portion of the waters which formerly flowed from the mouth of the Mountain Lake tunnel now flow from the orifice of plaintiff's tunnel, all of which said waters formerly found their way under Nature's plan into the flowing stream of Snake Creek and supplied the natural volume of flow thereof.

10. That by the digging of its said tunnel plaintiff has interfered with the natural supply of the flowing waters of Snake creek and before the digging of said tunnel the natural subsurface water supply of said creek found its way through natural channels gradually through the summer months into the surface stream thereof and maintained the surface stream at a practically constant flow, uniform in volume relatively during the low water season of each and every year. That by the digging of said tunnel and the cutting of the subsurface stream within the bosom of the mountains a way of less resistance for the waters stored in the mountains during the winter season was opened and by reason thereof the stored waters from within the mountains drained off more rapidly than they would and the period of extreme low water occurs earlier in the season and by

reason thereof defendants are deprived of water during such reason which they otherwise would and have had and so deprived during the irrigation season of each year when water is most useful and necessary for the maturing of their [*corps*].

11. That the driving of said tunnel is a continuing trespass upon the rights of these defendants and defendants allege upon their information and relief that if plaintiffs are permitted to extend said tunnel further into the mountain that the same will so lessen the water supply during the low water season as to render a portion of the farms and homes of the defendant corporation's stockholders valueless and defendants allege upon information and belief that plaintiff will continue to extend said tunnel deeper into the mountains and further trespass upon the rights of defendants unless restrained by order of this court and unless plaintiff is restrained by order of this court and unless plaintiff is restrained from asserting claim of ownership to the right to the use of the waters flowing from said tunnel, it will wrongfully continue to do so to the great and irreparable injury of defendants and for all of which acts defendants have no adequate legal remedy.

15 Wherefore, defendants pray that plaintiff take nothing by its action and that its complaint be dismissed.

That plaintiff and all persons claiming by, under or through it, be perpetually enjoined and restrained from asserting or claiming any right, title or interest of in or to the waters flowing from said tunnel and the defendants be adjudged to be the owners of the right to the use thereof and of such quantity as may hereafter flow therefrom and that their title thereto be quieted and confirmed and that the plaintiff, its officers, agents, servants and employees and each of them be forever enjoined and restrained from in any manner whatsoever interfering with defendants' full, free and unrestricted use thereof and that plaintiff, its successors and assigns be forever enjoined from extending said tunnel further into the mountain.

Defendants pray for general relief and for costs.

(Signed) THURMAN,
WEDGWOOD & IRVINE,
Attorneys for Defendants.

STATE OF UTAH,
County of Wasatch, ss:

Wilford Van Wagonen being first duly sworn, on his oath says that he is one of the defendants above named and an officer of the defendant corporation, to-wit, the president thereof and as such makes this verification in its behalf and in his own behalf, that he has read the foregoing answer and counter claim, knows the contents thereof and that the same is true of his own knowledge except as to matters therein stated upon information and belief and as to such matters he believes it to be true.

[SEAL.] (Signed) WILFORD VAN WAGENEN.

Subscribed and sworn to before me this 27th day of August, 1914.
(Signed) WM. L. VAN WAGONEN,
Notary Public.

My commission expires Jan. 4th, 1917.

Copy received this 29th day of August, 1914.
HOWAT, MACMILLAN & NEBEKER,
Attorneys for Plaintiff.

Endorsed: Filed in the District Court on August 29, 1914.

16 *Reply.*

The plaintiff, for reply to the counter claim of defendant herein:

1. Admits the allegations of paragraph 1 thereof.

2. Replying to paragraph 2 of the counter-claim, the plaintiff says that it is without knowledge as to whether the defendants, or either of them, or their grantors or predecessors in interest, or any of them, more than twenty-five years next preceding the commencement of this suit, or at any time, acquired by appropriation and diversion, or otherwise, the ownership, or became entitled to the use, of all or any of the waters or water rights of said Snake Creek, for the purposes of irrigation, domestic, or other beneficial uses.

The plaintiff further replying to said paragraph 2 denies that the defendants, or either of them, or their grantors or predecessors in interest, or any of them, ever owned, or had the right to the use of, any of the waters flowing from the tunnel of the plaintiff into said Snake Creek.

3. Replying to paragraph 3 of the counter-claim, the plaintiff admits that Snake Creek rises on the eastern slope of the Wasatch range of mountains and flows easterly towards and into the valley where the waters taken by the defendants from Snake Creek are used.

Replying to paragraph 4 of the counter-claim, the plaintiff admits that the natural sources of the waters of Snake Creek consist of rain, melting snow and seepages, but the plaintiff is without knowledge whether before the construction of tunnels in the canyon through which said creek flows, during the spring, summer and fall months of each year the springs and seepages ordinarly supplied the greater portion of the waters flowing in said creek, or where the main reliance of the defendants, or either of them, for the supply of water in Snake Creek for the irrigation of their lands or for domestic or other beneficial purposes.

5. Replying to paragraph 5 of the counter-claim, the plaintiff says it is without knowledge whether the springs and seepages had their source in the bosom of the mountains on which they were [situate], and is without knowledge whether the springs and seepages found their way to the surface of the mountains through natural channels

or fissures in the rock imbedded in the mountains or thereby reached the surface or found their way into said creek, or were the natural tributaries or feeders thereof.

6. This plaintiff denies that the springs or seepages that found their way into Snake Creek were interferred with by the tun-
17 nel of the plaintiff, or of the Mountain Lake Mining Company.

6. Replying to paragraph 6 of the counter-claim the plaintiff says that no part of the waters issuing from the tunnel of the plaintiff and flowing into, and in, Snake Creek, or any water right therein is owned by the defendants, or either of them, and the plaintiff is without knowledge whether all the waters [naturally] flowing into Snake Creek are necessary, when economically used, for the purposes and uses of the defendants, or either of them.

7. Replying to paragraph 7 of the counter-claim, the plaintiff admits that on or about the month of April, 1910, it commenced to drive and construct the tunnel in question into the mountain and had driven the same therein for a distance of substantially eight thousand feet at the time of the commencement of this action; and that the portal of said tunnel is in the canyon through which Snake Creek flows, and that from the mouth of the tunnel a substantial quantity of water flows, sufficient to irrigate several hundred acres of land, but the plaintiff denies that the driving of the tunnel was in violation of the rights of the defendants, or either of them, and denies that the waters that flow through and out of said tunnel into Snake Creek prior to making of the tunnel found their way into the channel of Snake Creek through underground channels and sources; denies that the making of said tunnel cut off any supply of water that formerly flowed into Snake Creek, and denies that in the making of said tunnel the plaintiff undermined, cut off, or diverted any underground flow of streams, springs, or seepages constituting the permanent, or any, source of supply of waters of said Snake Creek, or thereby caused said waters to flow into and out of said tunnel. The plaintiff denies that by the making of said tunnel it undermined, intercepted, cut-off, or diverted any of the waters that formerly flowed into Snake Creek, or that any streams, springs, or seepages were prevented from reaching the surface of the ground through the natural channels theretofore existing or that because of the driving of said tunnel any springs or streams ceased to flow through the natural orifices into said Snake Creek, and denies that any of said springs or streams were diverted or caused to flow into and through said tunnel.

18 8. Replying to paragraph 8 of the counter-claim, the plaintiff admits that it claims all of the waters flowing in and issuing from said tunnel, and that it claims the same adverse to the defendants and each of them, but the plaintiff denies that such claim is in violation of the rights of the defendants, or either of them, or that the claim is unlawful, or unconscionable, inequitable, or without foundation of right.

9. Replying to paragraph 9 of said counter-claim, the plaintiff admits that prior to the digging of the tunnel described in plaintiff's bill, the Mountain Lake Mining Company dug a deep tunnel into the mountain, as stated in defendants' counter-claim; but denies that the tunnel of the plaintiff is driven underneath, or substantially underneath, the tunnel driven by said Mountain Lake Mining Company. As to whether the driving of the Mountain Lake Company's tunnel dried up any spring which theretofore had come to the surface, or which, when the head of Snake Creek Canyon was bare of snow constituted, or contributed to, the head waters of Snake Creek, and whether after the driving of the tunnel the waters which formerly came to the surface through said springs, thereafter flowed out of the mouth of said Mountain Lake tunnel, this plaintiff is without knowledge. The plaintiff is without knowledge as to whether since the driving of the plaintiff's tunnel by plaintiff the volume of water flowing out of said Mountain Lake tunnel has receded to substantially one-third of the volume that flowed therefrom before the construction of plaintiff's tunnel, or at all, and denies that the greater, or any, portion of the waters which formerly flowed from the mouth of the Mountain Lake tunnel now flows from the plaintiff's tunnel, and deny that all, or any, of said waters formerly found their way before the driving of the plaintiff's tunnel into Snake Creek and supplied the natural flow thereof.

10. Replying to paragraph 10 of the counter-claim, the plaintiff denies that by the digging of its tunnel it has interfered with the natural supply of the flowing waters of Snake Creek that before the digging of the tunnel was the natural subsurface water supply of Snake Creek, or that any of the waters now flowing into the plaintiff's tunnel prior to the construction thereof found their way through natural channels gradually through the summer months into the surface stream thereof, or maintained the surface stream at a practically constant flow uniform in volume relatively during the low water season of each year; denies that by the digging of
19 said tunnel the subsurface stream within the bosom of the
mountain other than percolating waters, were cut and the waters thereof diverted into said tunnel, and denies that any subsurface stream, the waters of which formerly flowed into said creek, were diverted into the plaintiff's tunnel and thereby prevented from flowing naturally into said creek; and denies that by reason of the construction of said tunnel the stored waters from within the mountains drained off more rapidly than they would or that by reason of the making of the tunnel the defendants, or either of them, are deprived of water during such season which they otherwise would have had, or that they are thereby deprived of any water during the irrigation season of each or any year.

11. Replying to paragraph 11 of the counter-claim, the plaintiff denies that the driving of the tunnel is a continuing, or any, trespass upon the rights of these defendants, or either of them, and denies that if the plaintiffs are permitted to extend the tunnel farther into the mountain that the same will further lessen the water supply

of the defendants, or either of them during the low water season, so as to render a portion of the farms or homes of the defendant corporation's stockholders valueless or diminish the value thereof. Plaintiff admits that it intends to extend said tunnel farther into the mountain, but denies that the same will be a trespass upon the rights of the defendants, or either of them; admits that unless plaintiff is restrained by an order of this court that it will continue to assert the claim of ownership of the water issuing from the tunnel and of the right to the use of the waters flowing from said tunnel, but denies that such claim will be wrongful, or that the same will work great, or irreparable, or any, injury to the defendants or either of them.

(Signed) ANDREW HOWAT,
H. R. MACMILLAN,
FRANK K. NEBEKER,
Solicitors for Plaintiff.

STATE OF UTAH,
County of Salt Lake, ss:

G. W. Lambourne, being first duly sworn, deposes and says that he is an officer, to wit, secretary-treasurer, of Snake Creek Mining & Tunnel Company, a corporation, the plaintiff above named, and, as such officer, makes this verification for and on behalf of said corporation; that he has read the foregoing reply and knows the contents thereof, and he verily believes the same to be true.

(Signed) G. W. LAMBOURNE.

20 Subscribed and sworn to before me this 29th day of October, 1914.

[SEAL.] N. W. BEST,
Notary Public, Salt Lake County, Utah.

My commission expires, August 14, 1916.

Copy received this 29th day of October, 1914.

(Signed) THURMAN, WEDGEWOOD & IRVINE,
Solicitors for Defendants.

Endorsed: Filed in the District Court on October 29, 1914.

(*Opinion of the District Court on the Merits of the Case.*)

The subject matter of the litigation in this action is that part of the stream of Snake Creek which flows from the tunnel of the plaintiff into the channel of said creek above the points of diversion of the water of said creek by the defendant company.

The plaintiff claims the ownership and right of diversion and use of said tunnel waters on two grounds, namely:

First. That the waters encountered in the construction of said tunnel and flowing from it are new or developed waters, that is to

say, that the development of the waters flowing in and from said tunnel has not decreased the natural flow of Snake Creek or of its sources or tributaries, but, on the contrary that the natural flow of said stream has been increased to the extent of the volume flowing from said tunnel.

Second. That the stream flowing from said tunnel is percolating water and belongs to the plaintiff as the owner of the tunnel and as the owner of or by reason of being in possession of the lands in which the tunnel is constructed.

The defendant company claims said tunnel waters and the right to divert the same for the use of its stockholders by virtue of appropriation and use of all of the waters flowing in Snake Creek long prior to the construction of said tunnel by plaintiff.

The defendant company bases [*is*] claim to said tunnel water upon three grounds, namely:

First. That said waters are not new or developed waters and have not increased the flow of Snake Creek.

21 Second. That the waters encountered in the construction of said tunnel and flowing therefrom are not percolating waters but waters theretofore finding their way into the sources of Snake Creek or into the channel of Snake Creek or its tributaries through known or defined underground channels; and

Third. Even if it is admitted that said waters are percolating waters, they theretofore fed the sources of Snake Creek and its tributaries, or found their way into the channels of said Snake Creek or its tributaries and would have continued to do so except for the construction of plaintiff's tunnel.

The appropriation and use of the waters of Snake Creek as claimed by the defendant company is not in dispute.

It appears that the plaintiff is the owner of the quarter section of land described in the complaint and that the portal of the tunnel is upon this quarter section. The tunnel is run for a distance of about three miles into the mountain and for a long-distance into other land than the quarter section owned by the plaintiff. The water encountered in the tunnel was found in lands other than that owned by the plaintiff. This fact is referred to by counsel for the defendant in his brief but the question is not argued. The plaintiff is in possession of and control of the tunnel, and no reason has occurred to me why the ownership of the land through which the tunnel is constructed should have any controlling influence in the determination of the case. The owner or owners of these lands, whether private parties or the United States, have apparently acquiesced in the acts of the plaintiff company in constructing the tunnel, and their rights in the premises are not in question, and their rights, whatever they may be, cannot be taken advantage of by the defendant company in this action.

The tunnel in question is driven into the mountain side which constitutes a part of the natural surface water shed of Snake Creek and its tributaries, and, as before stated it is claimed by the defendant company that at the depth into which the tunnel runs these mountains constitute the underground source of supply of Snake Creek, its tributaries and other sources.

On the other hand, it is claimed by the plaintiff, as already stated, that the waters found in the depths where the tunnel is run do not constitute and have never constituted any part of the sources which supply the flow of Snake Creek.

22 The parties by their counsel have submitted carefully considered briefs upon these questions of fact, each vigorously contending that the evidence in the case shows the fact to be in accordance with their respective contentions. I find, however, after a careful review and consideration of all the evidence in the case, the result to be most unsatisfactory. My mind is left in that uncertain state which distinctly suggests the application of the rule of burden of proof to the solution of the questions of fact to be determined.

A large part of the evidence upon the matter under consideration is opinion evidence, and that which is not, consisting of measurements made by various parties, is insufficient both in quality and number to warrant a judicial decision with any sense or feeling of certainty that the decision was just or in accord with the actual facts. A cursory consideration only of the evidence develops the difficulties above suggested.

The plaintiff introduced testimony of experts tending to show that the dip of the formation in the mountains in which the tunnel is run is such that the waters found therein would seek an outlet toward the northwest and away from the surface in which are found the sources of Snake Creek and its tributaries and over which Snake Creek and its tributaries flow. The dip of the formation as exposed by the tunnel, as well as the existence of the porphyry dikes, makes the views of the experts plausible that the waters encountered in the tunnel are new or developed waters and that these waters would never in the course of nature find their way to the surface and into the channel of Snake Creek.

This view might be conclusive of the case, or, at least sufficiently convincing to satisfy, if the indubitable fact did not exist that water does and has always come to the surface in that neighborhood in springs and seeps which in low water season made the stream of Snake Creek. These sources of supply of Snake Creek come from below the surface and in spite of the dip of the formation or the existence of dikes as found in the tunnel.

The defendant company introduced testimony of its stockholders and water users that there has been no more water flowing in the channel of Snake Creek at the points of diversion by them than flowed therein normally prior to the construction of the tunnel. Of course the important fact to be determined is whether there is more water in the creek immediately above the head-gates of the

defendant company than there had been previous to the construction of the tunnel.

23 The best that can be said for the testimony of the water users is that they gave their best judgment, in short, their opinions.

When it is remembered that Snake Creek is a mountain stream the flow of which varies not only from year to year but from day to day, and when it is remembered that the water of the stream was diverted and used through a number of separate canals and ditches, and when we do not know in any particular case or year what lands were cultivated or what crops were cultivated thereon, or the nature of the seasons compared one with another, there is added to the unsatisfactory character of opinion evidence so many unknown factors that the mind is not at all convinced that the contention of the defendant company is any more likely to be correct than the contention of the plaintiff company as above indicated. Nor is the uncertain state of mind above suggested relieved when consideration is given to the testimony that one second foot of water is necessary to the proper irrigation of seventy acres of land, and that 3,500 acres have been brought into a state of cultivation by use of the waters of Snake Creek. It is in evidence that there is an abundance of water for all purposes and uses flowing in Snake Creek during the highwater period which continues until about the first of July of each year. From about that date until the end of the irrigation season is what is termed the low water season. The amount of water needed and actually used during the low water season depends upon the crops cultivated and grown upon the land, some crops requiring water for their maturity at a much later period than other crops. Timothy, red-top, etc., do not require irrigation as late as do potatoes, beets, spring grain, garden vegetables, and many other crops that might be mentioned. The amount of water required for the irrigation of lucern, for instance, depends upon the number of crops sought to be harvested. To determine the amount of water required and actually used by the farmers during the low water season, based upon the acreage of the water users and the duty of water per second foot, one must know with more certainty than appears by the evidence in this case the kind and acreage of the crops grown upon the land. Evidence was introduced of measurements made by various parties covering a number of years. Confessedly measurements made by the so-called float method are at best only approximations. The measurements made by current meter or by weir, if properly made, are reasonably accurate, but I am unable to give the effect to any or all of these measurements claimed by either party.

24 The float measurements are too unreliable, and all the measurements taken together are entirely too few in number to justify any general conclusion to be drawn therefrom.

As already observed, Snake Creek is of that character that its flow changes more or less from day to day, and changes from week to week and month to month are likely to be abrupt and considerable. The variations found at the same period in different years are likely to be large. I am not convinced that the measurements introduced

in evidence are sufficient in this case to justify a conclusion of the ultimate fact in dispute between the parties.

If we assume that neither party is correct in its contention and assume that the probabilities are that there has been some new water developed by the plaintiff and some water diverted from the sources of Snake Creek through the tunnel, one is still at a loss to determine the quantity of increase or of loss.

The evidence is in that state, as already suggested, that requires recourse to the rule of burden of proof. Burden of proof is a question of law which I will revert to hereafter.

Under the ordinary and usual definition I am satisfied that the water flowing from the tunnel is percolating water. From the exposure made in the tunnel the rocks appear to be broken into large blocks with crevices and openings between. The water, of course, does not permeate the rocks as in soils, and is not held in suspension homogeneously as it is, or is supposed to be, in soils or other porous earth. On the other hand, these fissures or openings between the rocks through which the water passes into the tunnels are not, I believe, underground channels with defined banks which are required to distinguish underground streams from percolating waters. Assuming, however, that these channels, or some of them, possess the characteristics at the point of exposure of underground channels and streams, there is nothing in the evidence that connects them as channels to any of the springs, the sources of Snake Creek, or to the channel of Snake Creek or its tributaries. There is no evidence in the case that any of the springs situated at the foot of the mountain near Midway have ceased to flow, or, in fact, that there has been any diminution in the flow of any of these springs.

It is, I believe, the contention of the defendant that a large part of the water flowing from the tunnel would, if let alone, have found its way into the channel of Snake Creek along its lower course and into the springs situated along its lower course, and that
25 there has been a diminution in the flow of the springs and in the channel by reason of the diversion of the water by means of the tunnel. If this contention is true the fair inference would be that these waters found their way to the springs and into the channel through percolation, as generally understood, rather than through open and direct channels.

In this case, assuming that any of the water cut by plaintiff's tunnel found its way to the surface and fed springs and seeps which the evidence here shows have gone dry, there is nothing in the evidence which shows how or by what means the water reached the surface. The fissures opening into the tunnel may or may not be continuous to the surface. Indeed, it would be the merest guess to say that these fissures or openings are continuous any substantial distance away from the point cut by the tunnel.

It seems to be the theory of both parties to the suit that the mountain into which the tunnel is run is in the nature of an underground reservoir which is fed, in part at least, from the surface by rains and melting snows sinking into the earth, and in part possibly by waters finding their way into the mountain in other ways. It is

the contention of the defendant, as already stated, that the tunnel intercepts waters of this underground reservoir that, left alone, would ultimately find their way into Snake Creek, and, in addition, it is the contention of the defendant that the tunnel, acting as an outlet, tends to lower the static head of the water held in the mountain, and as a necessary, well known physical result there is a decrease in the flow from the reservoir to Snake Creek and its tributaries. Assuming this latter theory to be true, it does not tend to establish that the water passes from the depth of the mountain to Snake Creek, or its tributaries through known or defined channels.

If, then, the waters flowing in and from the tunnel are percolating waters, the first question for consideration as a matter of law is, the rights of the parties in respect thereto, irrespective of whether the flow of Snake Creek has or has not been increased by the flow of the water from the tunnel.

Under what is usually called the common law or English rule, it is not disputed that the plaintiff is entitled to the use of the waters flowing from the tunnel, assuming that such water is percolating water, as I find it to be.

Much may be said in favor of each of these rules. On the part of the defendant it is urged that the adoption of the com-
26 mon law rule would place the farmer and agriculturist in this arid region at the mercy of the miner and mining interests. On the part of the plaintiff it is urged that a thorough-going adoption of the American rule would seriously interfere with mining development and enterprise in the State. The question thus presented for decision is a matter that, it seems to me, peculiarly concerns the State and its citizens. Its decision intimately affects property rights and is one that ought to be deliberately determined by the Supreme Court of the State. It would be intolerable for this court to adopt one rule, and the State court the other. It is unfortunate that the Supreme Court of the State has never definitely announced its adherence to either one rule or the other in any decided case. The rights of parties in respect to percolating water have been before the court a number of times. A definite pronouncement with respect to the matters presented in this case for decision is lacking, either by reason of the diversity of views of the members of the court, or by distinctions made by the court in the cases before it.

The latest case discussing the matters under consideration is Garns vs. Rollins, 41 U., 260. In this case the trial court adopted the American rule. The plaintiff appealed and in his brief relied upon the common law, or English rule. The Supreme Court found with the plaintiff but decided the case in his favor without approving or adopting the common law rule. In that case the court reviews the two rules and cites the authorities in favor of each, including, I believe, practically all of the cases relied upon by the respective counsel in the case at bar. Discussing the common law rule the court says:

"In this jurisdiction the common law doctrine as declared by the Supreme Court of California in the cases above mentioned, in so far

as applicable to the questions litigated in which was involved the right of the owner of the land to the percolating water fo*n*nd therein, has been adhered to and followed." Citing a number of Utah cases.

The Court further says:

"The trial court, in deciding the case at bar, evidently followed the American or reasonable use rule as announced by the late California cases and decisions from other jurisdictions which have departed from the common law doctrine on this point. The case under consideration, however, is not one involving the rights of parties to subterranean waters which find their way by percolation through lands owned by different parties and which have been intercepted
27 in and diverted from their natural course by one of the parties
to the injury of the other. The question of ownership of the percolating subterranean waters is, at most, only incidentally involved. On the question of whether the conditions in this state demand or require a modification of the common law doctrine of percolating waters, we shall withhold our opinion until some case is presented calling for it."

The court further says:

"It is sufficient to here state, without approving or disapproving the doctrine of the reasonable use rule, that the facts as found by the court do not bring the case within that rule."

It is evident from the quotation first above made that the writer of the opinion in the case quoted from was of the opinion that in this jurisdiction the common law doctrine, or the English rule, has been adhered to and followed "in so far as applicable to the questions litigated, in which was involved the right of the owner of the land to the percolating water found therein." That it was the view of the learned justice, the writer of the opinion in that case, that the principles underlying the common law doctrine, or the English rule, had heretofore been applied to questions litigated in the cases before the court is further borne out by the statement that: "On the question of whether the conditions in this state demand or require a modification of the common law doctrine of percolating waters, we shall withhold our opinion until some case is presented calling for it."

The queries at once suggest themselves as to the pronouncements just quoted; first, is the court correct in the statement that the common law doctrine has been adhered to heretofore in this State; and, second, assuming that it has not, should this court by judgment in this case modify the common law doctrine in respect to percolating waters in advance of such modification by the Supreme Court of the State.

The Utah cases dealing with the law respecting percolating waters are as follows:

Sullivan vs. Mining Company 11 U. 438.

Crescent Mining Co. vs. Silver King Mining Co. 17 U. 444.

Herriman Irrigation Co. vs. Butterfield Mining Co., 19 U. 453.
Willow Creek Irrigation Co. vs. Michaelson 21 U. 248.
28 Herriman Irrigation Co., vs. Keel, 25 U. 96.
Whitmore vs. Utah Fuel Co. 26 U., 488.
Garns vs. Rollins, 41 U. 260.

And the cases of Roberts vs. Gribble, 43 U. 411, 479 affirming the doctrine laid down in Garns vs. Rollins found in 41 Utah.

The case of Garns vs. Rollins has already been referred to.

The court, in the case of Sullivan vs. Mining Company, held that percolating waters developed by the sinking of a well on public lands, was, under the statutes of the United States, the subject of appropriation, with the right of entry and use as against a private owner by patent from the United States. In the opinion of the court makes use of this language:

"This right of an appropriator is, of course, subject to the rule of law which will permit the owner to sink an adjoining well on his own premises although he should thereby dry up that of the first appropriator."

The question of the right of the owner of the premises to sink an adjoining well, and thereby dry up the well of the appropriator, was not in the case or before the court for decision. Nevertheless, with that view of the law in the mind of the court, it was very proper that it should in appropriate language, limit the effect of its decision of the case. It was easily foreseen that the situation suggested might arise between the parties to the action, and it might be very well claimed in such case that the matter in dispute was res adjudicata if no words of limitation had appeared in the decision. In so far as the case purports, by the expression above quoted, to decide matters not before the court, the expression is dictum. In so far as it is a limitation of the sweeping effect of the decision, it is a very clear recognition by the court of the existence and applicability of the common law doctrine respecting percolating water.

In the case of Crescent Mining Company vs. Silver King Mining Company, the court, upon the facts before it, decided that percolating waters developed by the running and excavation of a tunnel are not subject to appropriation, and that such waters belonged to the owner of the tunnel.

The court, in the course of the opinion in that case, makes use of the following language:

"The waters issuing from the artificial tunnel into the lake are found to be underground, percolating waters from the min-
29 ing claim of the defendant, and not waters naturally flowing in a stream with a well-defined channel, banks, and course. Under such a state of facts, the law seems to be well settled that water percolating through the soil is not, and cannot be, distinguished from the soil itself. The owner of the soil is entitled to the waters percolating through it, and such water is not subject to appropria-

tion. The ordinary rules of law applying to the appropriation of surface streams do not apply to percolating water and subterranean streams, with undefined and unknown courses and banks. When water percolates through and under the surface of the earth upon the land belonging to one person, and comes to the surface just before it empties itself upon the land of another, the owner of such land has no right to demand that such percolation shall continue. It is held that a person may lawfully dig a well on his own land, though thereby he destroys the subterranean, undefined, percolating water of his neighbor's spring, and no action will lie therefor."

The court then proceeds to the discussion of cases and quotes with approval from a large number upholding the doctrine announced in the above quotation. Among other cases the court refers to the case of Sullivan vs. Mining Company and says:

"The case of Sullivan vs. Mining Co., 11 Utah, 438 relied upon by the able counsel for the plaintiff, rests upon a different state of facts from those disclosed in this case, and is not in conflict with the principles here laid down. In that case defendant's predecessors in interest dug a well upon the public lands of the United States, and used water therefrom, for domestic and other purposes, for nearly 20 years. Thereafter the plaintiff located a mining claim, embracing the well within its boundaries, and brought suit for trespass against the occupants of the well. The court held the grantors of the defendant having located the well on the public domain prior to the location of the plaintiff's mining claim, that, by virtue of sections 2339, 2340, Rev. St. U. S., the plaintiff located his mining claim subject to the rights of the defendant and its grantors, and expressly recognized the principles here laid down—that percolating waters belong to the owner of the soil, and that the owner could dig a well upon his own ground, and thereby dry up the well, supplied by percolating waters of his adjacent neighbor without liability."

Under the facts in the Crescent Mining Company case it may very well be said that the broad and general approval of the common law doctrines respecting percolating waters was unnecessary to the decision, and, therefore, dictum. It is, however, a very clear
30 recognition by a unanimous court of the existence of the common law rule, and of the harmony of the court in respect to its application in this jurisdiction.

The case of Herriman Irrigation Company vs Butterfield Mining & Milling Company, 19 U., 453, is, upon the facts, very similar to the case at bar.

The court in this case held that certain of the findings of the trial court were not supported by the evidence, and the case was reversed and remanded for a new trial. The trial court in its sixth finding found that: "Neither of the tunnels cut nor diverted the waters of any underground channel or water course, or diverted any waters except those percolating in and from its mining ground by natural seepage." And the trial court also found in its sixth finding of fact:

"A preponderance of the evidence shows, and I find that since th Queen and Butterfield tunnels were made, some springs on the northerly side of Butterfield Creek and near the bed of the creek and it branches, and which flowed into the creek and its branches, hav dried, and some have diminished in flow. The most important c these are a mile and half from the line of the tunnels, and the were not the outlet of any sub-surface water course or stream havin any defined channel connecting them or extending to or beneatl the ground through which said tunnels extend."

The Supreme Court in its opinion, after quoting these findings proceeds as follows:

"The last sentence just quoted from said finding, and the portion of said finding before quoted, is not consistent with the first sentenc just quoted, and is not warranted by the evidence.

There was no testimony tending to show that these springs wer dried up from any other cause than the running of said tunnels They had been known to flow continually for thirty-eight years They ceased to flow when said tunnels were driven into the moun tains from which they issued. By common experience we know tha deep tunnels very frequently dry up, not only the springs in thei immediate vicinity, but also those remotely situated, that such re sults only follow when the tunnels cut the underground channel through which the veins of water which supply the springs flow.

The development of percolating water might diminish the flow o springs in the vicinity of a deep tunnel, because the underground channels of springs are supplied by percolation of wate
31 from the surface, but would not entirely dry them up, es pecially those remotely situated.

From the evidence and the findings that a number of springs (the evidence showed that there were about thirteen of them), which previously to the running of said tunnels had so continously flowed for so many years, were dried up, the conclusion is irresistible that said tunnels cut the underground channels through which said springs were supplied. This being so, as the waters which supplied these springs were diverted from their natural channel and discharged into the natural channel of Butterfield Creek at a different point than the one at which they naturally flowed into the stream, we are clearly of the opinion that the defendant company did not acquire a right to any of the water flowing from said tunnels except such as was developed by percolation, and that the plaintiff retains the right to all the water flowing in the natural channel of Butterfield Creek, diminished only to the extent of the increase of the quantity of water which naturally flowed in the channel of Butterfield Creek, before said tunnels were run, and said springs were dried up. This right of plaintiff is not affected because the underground channels of said springs are not traceable."

In so far as the doctrine under discussion is affected by the opinion of the Court just quoted, it seems to have been the view of the court that the drying up of a spring coincident with the running of a

tunnel was very clear evidence of two facts; first, that the running of the tunnel diverted the water theretofore flowing to the spring; second, that a natural waterway or channel with defined bed and banks existed between the point of diversion in the tunnel to the spring; and as in that case the distance between the tunnel and the springs in question was as much as a mile and a half, the court announced this rule to govern in such cases: "This right of plaintiff is not affected because the underground channels of said springs are not traceable."

Except as to the rule above quoted, the opinion in the case does not present any departure from the common law doctrine respecting percolating waters.

This same case was again before the Supreme Court and is reported in 25 Utah, supra.

The trial court on the second trial of the cause, notwithstanding the views of the Supreme Court as above quoted, in its ninth finding of fact found as follows:

32 "That the driving of said tunnels, or either of them, did not dry up or diminish the flow of any spring or springs in Butterfield canyon, or in Tooele fork or Spring gulch, or any spring or springs flowing into Butterfield Creek or any tributary thereof. If any such springs dried up or diminished the flow, it was from other causes than said tunnels or either of them."

Before the Supreme Court at the second hearing it was claimed that the decision reported in 19 Utah rendered the questions presented upon the second appeal res adjudicata. This contention is discussed and opposed by Judge Bartch, and discussed and maintained by Judge Baskin. Judge Bartch also discusses the evidence before the trial court and approves the findings made by that court. Thereafter, in his opinion, Jude Bartch approves in a most thorough-going way the common law doctrine respecting percolating waters. Judge Baskin, who wrote the opinion reported in 19 Utah, on the other hand, in his opinion maintained that the questions before the Court were res adjudicata by reason of the former decision, and disapproves the findings of the trial court above quoted. He says: "It is clear from the evidence that at least one-half of the water which flows from the tunnels into Butterfield creek is drawn from the underground channels of the springs which were dried up."

Judge Baskin then proceeds to discuss with approval those cases which have modified the common law rule and adopted what is commonly known as the American rule.

We thus have a hopelessly divided court upon the matter of the rules under consideration, and must, therefore, look to the opinion of Judge Miner to obtain results. He says:

"The testimony taken in this case is conflicting, contradictory, and not altogether satisfactory; yet to my mind it tends to show that, prior to the construction of the defendants' tunnels, large

quantities of water did flow from plaintiff's springs into Butt Creek. After the construction of said tunnels, this flow of was greatly diminished, and some of the springs dried up. I appears that small underground water courses, seams or cha and fissures in the rocks, through which water had once run fed some of plaintiff's springs that flowed into the creek ar visible. These underground water courses that fed the plai springs prior to the construction of the defendants' tunnels, sl
in some instances, to be well defined, were cut by th
33 fendants' tunnels and considerable water that formerl
the springs was carried through them into the stream b and was thereafter appropriated and used by the defendants t injury of plaintiff, and the water accustomed to flow fron springs to the creek thereby diverted. It also appears that con able water flowing out of the mouths of the tunnels *in* seepage that has no connection with plaintiff's springs, and to whic plaintiff can lay no claim."

He further says:

It is quite manifest from the facts and circumstances shown about one-half of the water flowing out of the tunnels was di from the plaintiff's springs, in the manner aforesaid, by the struction of the tunnels, and this caused many of them to dr and impaired the flow of waters from others."

After some discussion of the division of water between the pa he says: "In other respects I concur in the opinion of Mr. Ju Bartch." The concrete results of the case was that the appr ators of the stream were adjudged to be the owners of the w flowing from the tunnel that Judges Baskin and Miner found theretofore flowed from the springs which had dried up. Kee in mind that the springs in question were a mile and a half di from the tunnels, the concurrence of Judge Miner with J Baskin in the conclusion that the prior appropriators were ent to the ownership and use of so much of the tunnel waters as t tofore had flowed from the springs, one would conclude tha adopted and applied the rule announced by Judge Baskin in opinion reported in 19 Utah that: "This right of plaintiff is affected because the underground channels of said springs are traceable." However, a careful consideration of the language by Judge Miner in his opinion makes it apparent that he r upon certain visible physical evidences for his conclusion. He s It also appears that small underground water courses, seam channels and fissures in the rocks, through which water had run that fed some of the plaintiff's springs that flowed into creek, are still visible. These underground water courses that the plaintiff's springs prior to the construction of the defenda tunnels, shown, in some instances, to be well defined, were cut the defendants' tunnels and considerable water that formerly the springs was carried through them into the stream below."

membering, as I have said, that the springs and tunnels
4 were a mile and a half apart, it is very evident that Judge Miner inferred the existence of continuous underground channels between the springs and tunnels from the visible signs appearing at the surface and in the tunnels, rather than applying in a thorough-going way the rule announced by Judge Baskin above quoted. The inferences drawn by Judge Miner from the evidence in that case can, of course, have no controlling weight in the determination of the facts in this case.

I will now consider the case of Willow Creek Irrigation Company vs. Michaelson, reported in 21 Utah, 348.

In this case the court decided that the water of a bog or marsh formed on privately owned land is not subject to appropriation and belongs to the owner of the land. The decision in this case was written by Chief Justice Bartch, and though perhaps unnecessary to the decision, he discusses at some length the doctrine of percolating waters and very clearly foreshadows the views expressed in the case of Herriman Irrigation Company vs. Keel, already discussed.

The case of Whitmore vs. Utah Fuel Company, supra, is a review of the facts found by the trial court, and is of no great importance in respect to the matters now under consideration. However, the court announces its position with respect to underground streams in this language:

"That known underground streams of water flowing in well defined channels, such as the one under consideration is shown to be, are subject to appropriation, and that rights acquired in them by appropriation cannot be diverted by the wrongful act of another, is so well settled that we deem it unnecessary to enter upon a discussion of the question."

The Herriman case is not cited or referred to in the opinion. The opinion in the Whitmore case was written by Judge McCarty, the writer of the opinion in the case of Garns vs. Rollins heretofore referred to. Attention perhaps should be called to the following statements found in the opinion: "The findings of fact made and filed by the (trial) court in the first cause of action, so far as material here are as follows:

"That the said well (referring to the new upper well) is supplied by waters percolating through the soil under the surface thereof, and moving therein, within any definite channel, and in courses which are unknown and unascertainable; that the sinking of said well intercepted water percolating in the soil under the surface of the ground, which, but for said well, would have reached
35 said springs, and become a part thereof, by percolating through the soil to said springs; that the sinking of said well intercepted these percolating waters before they reached said spring, and collected them in said well, from which they were pumped for the supply of water for the inhabitants of Sunnyside, as aforesaid."

Referring to this same well, Judge McCarty says:

"It is shown that the pumping of water from the new upper w had no effect whatever on the water standing on the old town w and the one excavated by Whitmore, which wells are situated mu nearer the spring than the one from which the water was tak This, together with the fact that for a period of four weeks duri the months of August and September, 1901, no water was tak from either of the upper wells and the spring still remained d tends strongly to support the contention of respondents that th was no connection between the waters that supplied the wells a those that fed the spring.

The trial judge who heard the case not only had all these fa before him, but he made a personal examination of the several we and the springs referred to, and fully understood the conditions they existed there, and we are not prepared to say that the findin on this point are not supported by the evidence. In fact, we thi that the preponderance of the evidence shows that the pumping water from the upper wells did not deprive plaintiff of any wa which he had theretofore appropriated."

It is difficult to say whether the learned judge intended to d agree with the trial court as to the fact in the findings above quot or whether it was intended to express the view that percolating wat such as found by the trial court, was not subject to appropriati when he says: "We think that the preponderance of the eviden shows that the pumping of water from the upper wells did not depri plaintiff of any water which he had theretofore appropriated.

In the unreported case of Ontario Silver Mining Company Wasatch Irrigation Company involving the ownership of percolati water, decided in 1908, Judge Marshall of this court in his opini said:

"The law of Utah with reference to percolating water collected a tunnel was laid down by the Supreme Court of the State in Cresce Mining Company vs. Silver King Mining Company, 17 Utah, 4 and as so determined precludes any assertion on the part
36 the defendants of the right to use the water flowing from t tunnel based on an appropriation after the running of t tunnel, or on user or prescription. The case fully committed t court to the common law rule as to percolating water. This ca was followed in Willow Creek Irrigation Co. vs. Michaelson, 21 Uta 248, where it was applied and approved. Then followed the ca of Harriman Irrigation Co. vs. Keel, 25 Utah, 96, which it is claim by the defendants leave the matter at large so far as the decisio of the Supreme Court of this State are concerned. In that ca there were three opinions. Judge Bartch held strictly in accord wi the prior doctrine of the court; Judge Miner purported to conc in the law so laid down, but, seemingly basing his conclusion on ev dence of an underground channel as distinguished from percolati water, decided against the tunnel owner; Judge Baskin adopted t view of correlative rights in percolating water. It may be that t

only logical method of supporting the decree was the doctrine of correlative rights, but the majority of the court did not adopt that method but repudiated it. In attempting to ascertain the law of this State as determined by its Supreme Court, I do not think it is permitted to indulge in the presumption that a proposition of law expressly repudiated is affirmed because, in my opinion, it is necessary to the conclusion reached."

It is thus seen that Judge Marshall reached the same conclusion with respect to the state of the law on this subject under the decisions of the Supreme Court of Utah reached in 1912 by Judge McCarty as announced in the case of Garns v. Rollins already quoted, namely:

"In this jurisdiction the common law doctrine as declared by the Supreme Court of California in the cases above mentioned, in so far as applicable to the questions litigated in which was involved the right of the owner of the land to the percolating water found therein, has been adhered to and followed."

I may add that in the Ontario Silver Mining Company case Judge Marshall adopts the common law rule as the basis upon which his decision of that case rests.

On the question of whether the conditions in this State demand or require a modification of the common law doctrine of percolating waters and which Justice McCarty in the case of Garns v. Rollins answered by saying: "We shall withhold our opinion until some case is presented calling for it." I am constrained to hold,
37 in view of the clearly expressed opinion of the Supreme Court of the State, that a modification of the common law rule, admitted to now exist, must take place, but that it is the duty of this court to recognize and apply this rule, at least until such modification shall have taken place.

A rule respecting percolating waters is one which intimately affects property rights and when definitely adopted should not lightly be departed from. However, I do not believe that the adoption of either one rule or the other would be followed by the dire consequences which the parties respectively suggest. As already stated, as I view it, it would be intolerable for this Court to adopt one rule and the Supreme Court of the State the other. If in the future the Supreme Court of the State shall definitely adopt the American rule, I shall have no hesitation in following such decision, notwithstanding the decision of this case, unless this court should be bound upon the question by the decision of the question by an appellate tribunal controlling in this court.

So far I have not referred to the case of Mountain Lake Mining Company v. Midway Irrigation Company, reported in 47 Utah, 346, for the reason that it does not discuss and does not purport to decide any question relating to percolating waters or the doctrine applicable to the same. The only question presented in that case for decision, and the only question discussed and decided by the opinion in the case, was as to the burden of proof. In that case Justice McCarty says:

"It is a well-recognized rule of law in this arid region, that where, as in the case at bar, a party goes upon a stream, the waters of which have been appropriated and put to a beneficial use by others, and drives a tunnel into the mountain or watershed drained by the stream, and immediately under or in close proximity to the stream collect water *which he claims to be developed water,* he must make satisfactory proof that such water is in fact "developed water." In such case it is immaterial whether the water, when encountered, is flowing in well defined subterranean channels or is percolating through the soil, gravel, and the fissures and crevices of the rock.
In either event, the presumption is, until overcome by satis-
38 factory proof, that the water is tributary to the main stream,
and the right to its use is vested in the prior appropriators of the stream."

5. (Italics mine.)

Justice Frick, concurring, says:

"My concurrence is based upon the sole ground that under the pleadings, as well as under the facts and circumstances, the burden of proof rested upon the respondents to show that the water they claimed, or at least a portion thereof, was what in law constitutes developed water."

Chief Justice Straup, in his opinion, says:

"About all the question of law involved is that of burden of proof. Because of the pleadings and of its demands, the plaintiff, let it be conceded, had the burden, not only of going forward, but also of establishing its alleged ownership of the disputed waters, and of the defendants' alleged invasion and interference. The case was tried on that theory."

Under the pleadings in the Mountain Lake case no claim was made of a right to the use of water flowing from the tunnel because the same was percolating water and belonged to the Tunnel Company by virtue of the ownership or possession of the soil through which the tunnel was run. The sole claim of right of ownership and of use was that the water intercepted in the tunnel was new or developed water, and in so far as the plaintiff in this action bases its right of recovery upon its claim that the water encountered in the tunnel is new or developed water, the cases are parallel and the Mountain Lake case is in point, and, notwithstanding most respectable authorities in other jurisdiction holding otherwise, I am constrained to follow and adopt the rule laid down in the Mountain Lake case as applicable to the facts in this case. Logically, under the pleadings as framed in this case, it may be conceded that the burden of proof would rest upon the defendant company. As framed in the Mountain Lake case the burden of proof logically rested upon the plaintiff or owner of the tunnel, but when one person runs a tunnel into a watershed and collects water therein which he claims to be new water, and turns it into the stream which drains this same water-

shed, it would seem that in a practical administration of justice he ought to be required to assume the burden of proof and make good his claim that he has in fact added to the volume of the flow, irrespective of the manner in which the issue is raised under the pleadings. It is doubtless true that in such cases the party
39 upon whom is cast the burden of proof must fail. Such failure follows inevitably from the uncertainty which attaches to the proof which is capable of being offered. The evidence in this case illustrates the uncertainty and unsatisfactory character of the proof which necessarily must be relied upon in cases of this kind.

The Mountain Lake case and the others of like character reviewed by the Supreme Court of Utah in the decisions above cited, very clearly illustrate the diversity of views which different tribunals, and different members of the same tribunal, take of the same state of facts. If it is difficult to reach a determination in respect to small streams like Snake Creek and the stream involved in the Herriman case, the difficulty of reaching a conclusion in the case of larger streams, as Provo river, would be insuperable.

Upon the whole case I am of the opinion that the plaintiff has failed to sustain the burden of proof upon its claim that the water encountered in its tunnel, or any definite part or portion thereof was new or developed water, and I am of the opinion that the common law rule respecting percolating waters should be applied in this case to the water flowing in and from the tunnel.

[Judg-ment] will be entered accordingly.

Endorsed: Filed in the District Court on December 18, 1918.

(*Decree of the District Court, January* 1, 1919.)

This cause came on to be heard before the court, Honorable Tillman D. Johnson, Judge of said court, presiding, the plaintiff appearing by Howat, Marshall, Macmillan & Nebeker, its solicitors, and the defendants by Wedgwood, Irvine and Thurman, their solicitors; and the court having considered the evidence and the arguments of counsel and being fully advised in the premises, it is by the court ordered, adjudged and decreed that the plaintiff is the owner in possession and entitled to the possession of all of the water flowing in and from that certain tunnel belonging to plaintiff, the portal of which is situate upon the following described parcel of land in Wasatch County, State of Utah, to-wit:

[T-e] northeast quarter (¼) of Section eighteen (18) Township Three (3) South, Range Four (4) east of Salt Lake Meridian.

40 It is further ordered, adjudged and decreed that plaintiff is the absolute owner of the right to use said water and to divert said water or an equivalent amount thereof, less the amount of such water lost between the portal of the tunnel and the point of diversion by seepage and evaporation from any stream or water course into or through which the same may hereafter flow.

It is further ordered, adjudged and decreed that said title of plai tiff in and to said waters and the right to use and divert the sam be, and the same hereby is confirmed and forever quieted in plai tiff against the defendants and all persons claiming by, through under them or either of them and said defendants and each of the and all persons claiming by or under said defendants or either them are hereby perpetually enjoined from claiming said water any part thereof and from interfering with the full, free and u interrupted use of the same by plaintiff, its agents, lessees or grante or successors in interest.

It is further adjudged that plaintiff have and recover the defen ants its costs, taxed at five hundred and seventy and 77/100 dolla and that execution issue therefor.

(Signed) TILLMAN D. JOHNSON,
Judge.

Endorsed: Filed in the District Court on January 1, 1919.

* * * * * * *

(*Statement of the Evidence.*)

(Filed in the U. S. District Court, February 10, 1920.)

Upon the hearing of the above entitled cause, the following ev dence was offered and introduced and the following proceedings ha on behalf of the plaintiff and the defendants:

During the reading of plaintiff's complaint it was stipulated b counsel for the respective parties that the third paragraph there should be amended to state:

"That on May 22nd, 1919, plaintiff's tunnel was driven in the mountains 14,500 feet and that 14.38 cubic feet per second water, or 6,454 gallons per minute, was discharging therefrom."

That such amendment might be made by interlineation or that new bill might be supplied.

41 It was also stipulated that defendants should have the rig to make such amendments to their answer as might be calle for by amendments to the complaint, and that defendants migh further amend their answer by alleging:

"That the plaintiff in this case drove this tunnel with the inter to wrongfully and against the rights of the defendants, deprive the of the waters of Snake Creek to which they are entitled."

The cause having been heretofore tried before Honorable Willia H. Pope, who died without rendering a decision, it was further stip lated that the evidence then taken, which had been transcribe might be read into the record and considered as a part of the ev dence in this trial.

Mr. MacMillan: I do not believe any statement of the proof w intend to offer at this time is necessary on behalf of the plainti

We will pursue the same course that was pursued at the trial before Judge Pope and rest our case upon the pleadings, taking the ground that the admissions in the answer of the allegations in the complaint make out a prima facie case for the plaintiff, and it is then for the defendants to introduce evidence as to their counterclaim.

Mr. Wedgwood: We do not admit that the plaintiff can rest and stay in court as to its complaint but we have filed a counterclaim and to rest the question upon the pleadings would not try out any issue or give any certain result, that is, decisive result, to either party, and, therefore, we will proceed under our counterclaim.

Wilford Van Wagenen, a witness procured by defendants, testified in substance as follows:

I am fifty-three years of age. Midway has been my home all my life.

The defendant Midway Irrigation Company is named after Midway town. Midway town is in Wasatch County; about three and one-half miles from Heber City; three miles from Charleston and twenty-five miles from Provo. It is a town in the sense that [—] has a town government.

The business of the people that live at Midway is farming and stock growing. There is, and has been, no other business there except a store or two. It is the center of an agricultural district of about 4,000 acres which supports about 180 families.

42 Midway has not been a growing community. It is now practically the same as it was ten or fifteen years ago. The area of land referred to was brought under cultivation thirty or thirty-five years ago and there has been no increase since that time. There has been practically no increase in the number of homes within the last twenty or thirty years; the popu- — is practically the same as it was twenty years ago.

The lands referred to are irrigated lands. The sources of water for their irrigation are Snake Creek and its tributaries and the Provo River.

Our company was organized in 1888. The water was practically all diverted at that time, but we have since had some little increase from the Provo River. We did not have sufficient water to irrigate our land.

All of the water available from Snake Creek and its tributaries has been applied to the irrigation of these lands ever since I can remember—thirty years.

The Midway Irrigation Company has no other business except the distribution of water.

I am acquainted with the country through which Snake Creek flows. Since I was a young man my business has been farming and stock raising and I have been engaged in lumbering in Snake Creek Canyon and at Charleston. My farming, stock raising and operation of mills has been partly in Snake Creek Canyon and partly in Charleston. My farms are southwest of Midway.

The country out of which Snake Creek flows is all mountainous before it reaches Midway. Snake Creek is not a stream that flows

a regular volume during the whole of the year, or one year with another. It fluctuates according to the snow and rainfall. It is about seven miles from the mouth of Snake Creek Canyon to the crest of the divide.

The main stream in Snake Creek Canyon is Snake Creek. Lavina Creek joins Snake Creek and there are several springs.

I am acquainted with the location of the orifice of plaintiff's tunnel. Before they were interferred with, Lavina Creek and Snake Creek naturally came together, about 150 yards a little south of east of the portal of this tunnel.

43 Among the perpetual flowing streams in the gulches of Snake Creek Canyon are Snake Creek, Lavina Creek, Mahogony Springs, Springer Springs and Twist Spring.

The supply of water for the domestic use of Midway is obtained from Gerber Springs, situate at the foot of the mountain towards the mouth of the canyon. Its waters are piped into Midway, but there is an overflow into Snake Creek and it is a perpetual flowing stream.

There is a continuous flow of water all of the year from the left hand fork of Snake Creek. There are other canyons which flow a part of the year, White Pine Canyon and Cariboo Gulch. The head of Cariboo Gulch is possibly one-half mile southeast of Clayton Peak. There were springs at the head of Cariboo Gulch. The water courses of the canyons are fed by rains, snows and springs.

As a result of my business I have observed the flow of the streams I have spoken of during the last thirty years. I think there was more water years ago than we are getting at the present time. It was always during the summer months, after the snows were off, that I was in the canyons. My attention was called to the quantities of water, because we had a water power in the canyon opposite the Snake Creek tunnel. I know what I accomplished with that water power. Since the driving of the Snake Creek and the Mountain Lake tunnels I have been on the creek at that, and other points. There is not one-fourth of the water there now that there was when I had the saw mill there.

I began to notice the diminution of the quantity of water in the main channel, at the point where I had my sawmill, at about the time they were encountering water in the Snake Creek tunnel. I have used water a good deal for irrigation, and in my mill work, and have seen others use it. I have built ditches myself and have in mind their carrying capacity.

In my judgment the normal flow of Snake Creek, above the point of confluence with Lavina Creek—at the point I have specified—was from sixteen to twenty cubic feet per second, prior to the time of the building of the Snake Creek tunnel, after the melting snows had disappeared.

I was acquainted with Lavina Creek during those years after the snows were melted and it is my judgment that we had more water in Lavina Creek prior to the starting of the tunnel than we have had since. Its average flow would be about seven to nine second feet.

44 I do not think we get as much water during the low flow of the creek as we did before the tunnel was built. The low flow comes earlier in the year than it did before. Considering a

ries of years, the snow water would be gone and the stream would ach its normal flow usually between the 20th of June and the 10th July, varying one year with another.

Ordinarily all of the snow in the Snake Creek drainage area goes f, and, when it does not very little remains. It is usually all off out the 10th of July, but it may be earlier. There is a stormy ason there, usually about the first of August, although we cannot ly upon it. Between the time the snow is off and the time we may pect these late storms there is ordinarily not much precipitation ere.

The precipitation during the winter of 1917 and 1918 was less than was last season; it was light compared with other years, but we ave had it just as light as it was last winter. We had a heavy snowll in 1916 and 1917 possibly three or four feet more than we had 1917 and 1918. In my judgment, since this tunnel was conructed, during 1913, 1914 and 1915 there has been no increase in e water available for the irrigation of these lands.

I have been, during the years back, acquainted with the Park City de of the divide; with the head of American Fork Canyon and the ead of Cottonwood. The fall of snow is practically the same rough the head of Bonanza Flat, Cottonwood and American Fork anyon. From Bonanza Flat and Cariboo Springs it is about three nd one-half miles to Park City. The crest of the divide lies about alf way between the two.

Cross-examination:

I was President of the defendant company a number of years ago. was also elected in 1915. There are seven members of the board f directors. I recall that the board of directors of my company urned water down the Provo River to the Provo Reservoir Company nder a demand from the Provo Reservoir Company that they be iven eleven second feet of water which they had leased from the Snake Creek Mining & Tunnel Company, being the water that came ut of the tunnel that is in dispute here. I don't remember as to the mount; they turned water down.

In 1913 a dispute arose in regard to the demand of the Provo Reservoir upon the Midway Irrigation Company to turn eleven second feet of water down to it. There was also involved in that
45 question some water from the Mountain Lake Tunnel. I took an active part in it.

I think I made my campaign for election as President of the company upon the ground that I disagreed with the board of directors in power at that time. I have taken a very active part in the preparation and trial of this case and am anxious to vindicate the position I took.

I testified in the former trial, but did not testify as to running a sawmill on Snake Creek opposite the present portal of the Snake Creek Tunnel. I knew it as well then as now. I was not asked in regard to it. I do not think I told our counsel about it.

I did not testify in the former trial that since the driving of these two tunnels (Snake Creek and Mountain Lake) the quantity of water

that the Midway Irrigation Company was receiving was less than it had received in previous years. I did not know so much about it then as I do now. I do not think the question was asked me at the former trial whether we were receiving less water since the driving of these tunnels as we received in previous years.

There were years previous to 1915 that we had a shortage of water, but I cannot recall the year. There may have been three, four or five years. I do not know as to that.

I operated the sawmill opposite the present portal of the Snake River tunnel thirty-three years ago; I think for two years. We were usually there from about the 15th of June to the 1st of October. The mill would saw probably 1,000 or 1,500 feet a day, of ten hours. I diverted the water, for the purpose of operating the mill, in a flume about 500 feet long. It was built of lumber and rectangular. According to my best judgment, it was about six feet wide and two feet deep. It usually ran nearly full, within three or four inches of the top. My best recollection is that the fall was one quarter inch to the rod, I diverted all of the waters of Snake Creek into that flume. The velocity of the water flowing through the flume would be three feet a second.

It was through that flume that I formed my judgment as to the amount of water that was flowing in Snake Creek, opposite the present location of the Snake Creek tunnel, above the confluence of Snake Creek and Lavina Creek. I did not attempt to measure the quantity of water that was going through the flume; I formed an estimate of the size of the stream. To convert this water into power we had what we called a pen stock, a box two feet wide, six feet long
46 and twenty feet deep; dropped the water in, then we had a 24
inch La Fell wheel at the bottom. I do not remember what the rating of the wheel was, nor the horse power developed. I think about a twenty horse power but we didn't develope that much power because we didn't have the water. I think about fifteen or sixteen horse power.

We had a shortage of water in 1913. I am not positive, but I do not think we had a shortage in 1914. We have had a shortage of water two or three times prior to 1913, but I cannot recall the years. My idea is that the average flow of Snake Creek during the low water season has decreased ten or twelve second feet since the Snake Creek tunnel was constructed. I did not know that as well at the last trial as I do now. They have been working the tunnel during and since the last trial and encountering new fissures of water and gradually draining out the water shed. Fissures, or underground lakes of water would of course drain the water shed.

The four thousand acres I have described have been under cultivation thirty or [thrity-five] years. There has been no increase since that time. The Midway Irrigation Company was organized in 1888 for the purpose of handling, controlling and distributing the water to the stockholders.

The low water period of the year would be from the 10th of July to the 1st of September. If, in any year, we had heavy precipitation, we would expect a heavy flow of the creeks during the low water

season, and if we had light precipitation we would expect a light flow.

I would say that during the same months that I was operating the mill there was from 16 to 20 second feet of water in Snake Creek and that there is now flowing in the creek five or six second feet where the mill was located. I think the decrease from 16 to 20 feet to the 5 or 6 second feet has been caused by the boring of this Snake Creek tunnel.

We can assume that in 1914 we had about the usual normal flow of water. I made a trip up there in 1913 and 1914 upon which I base my evidence that it had fallen off to five or six second feet. I was there in the latter part of July and in August 1913 and in 1914 the latter part of July. We had a shortage of water in 1915 from the 24th of July to the 1st of September. I do not think there was much difference between the flow in 1914, 1915 and 1916. We had an increase in 1917 on account of heavy snows. The shortage we have had would be since they started to encounter water in the tunnel. And that is a fact.

47 The first tunnel encountered the water in 1902 that is the mountain Lake tunnel. I think we had a shortage between 1902 and the time the Snake Creek tunnel started in 1909. I cannot recall whether we had a shortage in 1902 or 1903 or 1904 or 1905 or 1906 or 1907. The Snake Creek tunnel started in 1910, I think. I cannot recall whether we had a shortage in 1908 or 1909. We had a shortage in more than one year but not in all years. When the Mountain Lake tunnel went in, it caused some shortage; when the Snake Creek tunnel went in it caused a greater shortage. I cannot recall the years from 1909 to the present that we had a shortage. I would say, upon my own judgment, that there was a shortage of water since the commencement of the Snake Creek tunnel.

1917 was above the average flow, but, I say, take a period from 1902 to 1910, figure the average from 1902 to 1910, then the average from 1910 to 1918, and I claim there is a shortage from 1910 to 1918.

I want to be understood as testifying that for the last eight years the average flow of water was not equal to the average flow for the first eight. 1917 was a higher year than 1914, 1915 and 1916. I cannot recall whether 1908 was a low year or 1909 was a low year, or 1910, or 1911, or 1912 were low years; I remember 1913 was a low year.

I testified that in my judgment there was more water in Lavina Creek prior to the construction of these tunnels than there has been since, and that, according to my judgment, there were from seven to nine feet second feet in Lavina Creek before the tunnels were constructed at a point possibly 150 yards southeast of the portal of Snake Creek tunnel in July and August.

Independent of Mr. Call's measurements I would say there was more water in Lavina Creek prior to the construction of the tunnels than at any time since. I think I formed this judgment in about 1915. I estimated that, at that time, there were possibly six or seven second feet.

From the 20th of June the flow of the stream begins to recede. It

usually gets lower as the season advances. The low season is at about August 1st.

The water recedes earlier now than it did prior to the construction of the tunnels. Water runs very much earlier now than it would if there were no tunnels there. Possibly the low flow is July 20th now.

48 I mean to say that when the snow is melted, it finds these fissures and runs out sooner than it would if nature would take its course without the tunnels being there. I mean that the tunnel opening drained the underground supply quicker than it drained prior to the construction of the tunnel. I also mean there is more water flowing from the tunnel in July than there is in August.

In some years before the construction of these tunnels we had light falls of snow and a corresponding decrease in the flow of water resulting in a shortage during different years, and other years we had larger flow of water, so that the only way to get at a fair average is to take a cycle of years.

There would be very little difference in the snowfall on either side of the divide between Midway and Park City, if anything a little heavier in the head of Snake Creek on account of the elevation being a little higher. I do not think the precipitation at Heber would be half of the precipitation in the Snake Creek drainage area. Snow usually falls heavier in the tops of the mountains than in the valleys; often we have heavy snow in the mountains and only a rain down there, and it is often snowing in the mountains when it is cloudy down there. It would correspond from year to year, that is, if you had an increase of precipitation in the mountain you would have an increase in the valley.

White Pine Creek and Left Hand Fork of Snake Creek are usually dry between July 1st and July 15th. I am under the impression that Caribou has had a good stream running into Snake Creek continuously, that is, prior to the last three or four years. I don't know about the first three or four years because I haven't been there. That would not be an intermittent stream.

I testified in the former trial that Caribou usually does not carry water later than July 1st.

I was at Lavina Creek, at the point I referred to, prior to the construction of the tunnels pretty much every year.

At that point the creek was between four and six feet wide and possibly six or eight inches deep in the low water season and ran quite rapidly, possibly five or six feet per second, I never timed it. I simply formed a judgment by looking at it as the water flowed by. Going back to the mill which I ran the water would drop about 19 or 20 feet to the wheel. The depth of from six to eight inches would be the center of the stream; on the sides it would possibly be a couple of inches.

49 Redirect examination:

The defendant company has had all the water that has flowed down Snake Creek, whether coming into Snake Creek from the tun-

nels or elsewhere, except for a short period in 1913, yet, I say that since those tunnels commenced to flow—take it as a whole—there has been less water for our use in the low water season. The tunnels have cut the water shed and cut all the fissures, in the underground rocks and have drained the water shed two, three or six weeks earlier than if you let nature take its course and we do not get so long or steady a flow of water or steady amount of water.

Recross-examination:

In the former trial I testified that in 1913 the Board of Directors of the Midway Irrigation Company consented to the Provo Reservoir Company taking eleven second feet; four second feet on account of the Mountain Lake tunnel and seven on account of the Snake Creek tunnel. The four second feet taken by the Mountain Lake Company were taken under a decree of the State Court of Wasatch County. Three and one-half second feet of the waters of the Mountain Lake tunnel were awarded to the Midway Irrigation Company, the excess from the tunnel was awarded to the Mountain Lake Mining company.

Frank Wentz, a witness produced by the defendant, testified in substance as follows:

I live at Provo, Utah. I am a Civil Engineer by profession and have combined with Civil Engineering, the study of and practical handling of water for irrigation. I have given more or less attention to irrigation from 1902. From 1913 to the present, I have devoted all of my time to irrigation and the measurement and distribution of water.

In 1913 I was appointed a commissioner for the Provo River by the District Court of Utah County and have been acting under the court until the present time. As such commissioner I have made measurements of the Provo River up as far as Heber, and the distribution of the river according to the decree existing at that time.

Snake Creek discharges into Spring Creek and thence into the Provo River. I understand that Snake Creek is a natural
50 tributary of Provo River, and that the Snake Creek watershed is a part of the watershed of Provo River.

In my experience, derived from my duties, I have become acquainted with the lands irrigated under the Provo River system all along the river from Utah Lake through Utah, Wasatch and Summit Counties, embracing a total of 48,000 acres. I think the water requirements, per acre, for irrigation are about the same at Midway as for other parts of the system. I have distributed the water to Midway, Heber and Charleston for four years.

The fact is that a different quantity of water has been distributed to the different parties upon the river. During the high or flood water period we give them all of the water that is available that they can carry through their canals. They are given more water in the early part of the season than they are in the latter part of the season. They are given more water then because there is more water there at

that time of the year and by applying the water over this area we get a return of it through the underground sources, later in the season. Also, their necessities are greater in the early part of the season. The first irrigations are always heavier than the later because the ground is loose and requires more water to get it over and holds more than it does after it has been watered once. We have always given the upper district the larger quantity.

In the low water season there has been a different quantity given to the different places like Midway, Heber and Charleston, a different quantity one to the other. Midway has had a less quantity because we have not the supply available there to make up what they ought to have; they have not the supply from Snake Creek, and their diversion from the river is limited. This company uses from the Provo River five and one-half second feet from the Ontario Drain Tunnel and two and one-half second feet at the upper diversion, and at the lower diversion—through the island ditch—approximately seven second feet. That is in the low water season of normal flow, after the high waters have passed, which is about the fifth day of July. Before that they take about thirty to forty second feet through the upper or river ditch and as high as twenty-five second feet through the Island ditch and all of the flow of Snake Creek. Their right in the river is secondary and reduces down to eight in the upper ditch and seven in the lower ditch when the river drops to normal flow. Other rights that are ahead of Midway Irrigation Company are entitled to their supply before it gets any quantity
greater than eight second feet. During the high water sea-
51 son, and going from high to low water, we endeavor to give
Midway the same amount of water per acre as other canals.
When the normal or low water is reached they then have the least of any of the irrigators on the river, because the supply is not available.

The upper Provo river system, of which Midway is an incidental part, usually gets to the low or normal flow about the fifth of July. So far as any help from the river is concerned, Midway goes on the low water flow when the river reaches low water.

Referring to Exhibit 1, the red lines represent the crest of the ridges, and the yellow lines the bottom of hollows or gulches, in the Snake Creek watershed. Snake Creek tunnel is shown as a white line shaded *a*n either side with red, extending north-westerly from the northeast quarter of section 18 and is marked, "Snake Creek tunnel." The Mountain Lake tunnel is shown near the center of the East side of the map and is marked, "Mountain Lake tunnel."

Water has been flowing from these tunnels into Snake Creek. Snake Creek is the main line extending through sections 21 and 17. It is marked on the map "Snake Creek." The waters I have described for the use of Midway during the years 1914 to 1917 comprise everything coming from Snake Creek watershed, including the waters from the tunnels. With all of these waters, there is less water per acre to be distributed to Midway than to any other place on the Provo system.

Exhibit 1-A is a duplicate of Exhibit 1 down to the section line on the south side of Sections 19, 20 and 21, Township 3, South 4

East, except as to color. South of that line the area which is not shown on Exhibit 1 embraces the country in the vicinity of the town of Midway. The town is [shown] and is marked "Midway." The lands irrigated by the Midway Irrigation Company lie below the line marked "Probst Ditch"; also below the line marked "Midway upper canal"; embracing lands in Sections 26, 27, 28, 33, 34 and 35 and part of Sections 2, 3 and 4 of the same township, in other words they are indicated substantially as to exterior boundaries by the ditches marked on them.

For the years heretofore mentioned, I have distributed the water for the irrigation of those lands and measured the quantity given them in the Upper canal and the Island ditch from the Provo River. Their watermaster made the distribution as between themselves into their several ditches. The Island ditch heads in the south-
52 west corner of Section 36. Approximately 4,109 acres of land were served with the water I distributed; 4,000 acres of the Midway Irrigation Company and 112 acres of individuals that were under the Island ditch but not in the corporation.

The Court: Is there going to be any question in this case as to the necessity?

Mr. MacMillan: Necessity for water down there?

The Court: Of the waters that they claim, even including yours, if they had it?

Mr. MacMillan: We will admit that they would, if brought to the witness stand, testify that all the water from the Snake Creek area was necessary for irrigating their crops.

The Court: You expect to introduce no testimony to contest that phase of the case?

Mr. MacMillan: No, your Honor.

Mr. Wedgwood: I am not quite satisfied with just that condition; I want to go a little further.

The Court: If you have any other point in view to develop, why do so, but so far as the necessity is concerned, you can eliminate it.

General Wedgwood: I will do that, but there is another point I want to make in connection with this; of course, your Honor understands a case of this kind might go to another court, that might not be so well advised in those things as your Honor.

So the lands of the stockholders of the Midway Irrigation Company that are served are substantially in round numbers four thousand acres. A cubic foot of water would serve during those years fifty-five acres per second foot.

The Witness: On July 16th, 1914, the lands irrigated under the Midway Irrigation Company received one second foot of water for 80 acres; on August 28th, 1914, one second foot for 90 acres and on September 18th, 1914, one second foot for 90 acres. On June 26th, 1915, these lands received one second foot per 80 acres; on July 1st, 1915, one second foot per 100 acres; on August 25th, 1915, one second foot per 83 acres. July 7, 1916, one second foot for 90 acres. On August 13th, 1916, they received one second foot for 110 acres and on September 29th, 1917, one second foot per 80 acres. At these

times all of the water available for distribution to these lands
53 was distributed to them and it included the water from both
tunnels; all of the water from the Snake Creek shed.

During the past few years I have had opportunity to examine, study and determine the amount of water reasonably necessary to irrigate lands within the Provo River drainage area. As commissioner of the court I was given power, pending the trial, to determine what was and what was not, sufficient from time to time for the irrigation of lands under the system, and power to give or take from them more or less than they claimed, with the object in view of giving them what was actually demonstrated to be required. I found that a second foot for each 55 acres was sufficient and only sufficient. The older rights were given this amount and when the quantity was not sufficient to supply all upon this basis, the later rights stood all of the loss. During the flood water period I kept Midway under that 55 acre duty, but during the low water period I was not able to do so because the supply from Snake Creek and the 15 feet from the river, to which their right is limited, did not permit me to do so.

I am acquainted with the lands around Midway that are irrigated. They are of two characters; some are shallow, underlaid with pot rock and some are of deep and better soil. What is called "Pot Rock" is a limestone which lays flat over part of that country. Under the river ditches, some of the lands are porous and [gravely] and there are some meadow lands of deep soil.

Strickly speaking, the term "duty of water" applies where you have at your command such a quantity of water, to be used when needed, as will serve the land throughout the irrigation season. In the above sense, a "duty" is not possible in the Midway Section of the country, because the amount of water is not available to supply the quantity needed.

A modified definition of the "duty of water" is that if sufficient water to cover lands to a certain depth at stated times, and that is the sense in which I use the term of "duty" of 55; sufficient water to mature all of their crops. In my judgment, one second foot for each 55 acres under the Midway System is reasonable necessary during the low water season, to mature the crops on the lands under that system. At times, from 1914 up, they have had approximately fifty per cent of that amount.

Considering that such quantity is not available for them, they
should have a greater quantity in the first part of the season
54 in order to keep their irrigations all up prepared, as much as
they can, for the low water period.

I have known Midway as a farming community upon irrigated lands for about twenty-five years.

It is my judgment that Midway, during the twenty-five years I have known it, in order to maintain its lands under cultivation and keep them fruitful and productive, must never have had less water than they have had since 1914. In my judgment it would not be possible to have maintained that 4,000 acres of land under cultivation with less water.

Cross-examination:

I was appointed court commissioner in 1913 by Judge Morgan, of the District Court, of this State, sitting at Provo, under the decrees of 1902 and 1907, one rendered by Judge Morse and one by Judge Chidester.

I never made measurements of any portion of the waters of the Snake Creek drainage area prior to 1913. Prior to that I observed the lands from time to time when I was in Midway, but made no specific examination.

I made no particular investigation in 1914 except to measure the water and see how they were getting along. We attempted to keep all of the water users in the district below the Upper Midway dam on practically the same duty, that is, the same quantity per acre.

I am familiar with the company known as the Provo Reservoir Company; it was organized for the taking of the surplus water in the Provo River and diverting it onto high lands by the canal at the mouth of Provo Canyon, and the construction of reservoirs at the head of Provo River, to store flood waters and divert them through this canal to the high lands in Utah and Salt Lake Counties, and the diversion of those waters was for the purpose of cultivating crops, irrigating lands, and the reclamation of lands; in 1913 Provo Reservoir Company obtained water flowing from Snake Creek tunnel and diverted it in their canal at the mouth of Provo Canyon.

In 1915, within the Midway [distrist], we tried to get over the system two or three time a week and see that they were getting along. The purpose of the commissioner was to supply water to each company to mature all of the crops, only giving them what they could get along with and giving the balance to the later rights. I went over the lands quite often and observed them myself to see
55 if the water masters were keeping up with the schedule and keeping the lands irrigated.

In 1916 my examination was about the same as in 1915. The examination in 1917 was about the same.

I do not know of my own personal knowledge the quantity of water that was used on the lands embraced within the Midway Irrigation District prior to 1914. My judgment as to the use before is based on my examination made since, and the character of crops raised. The crops were about the same each year, just the two staple crops. Of course, I have to assume this in order to give my answer as to my judgment as to what happened prior to 1914. I never made any measurements of the waters of Snake Creek drainage area prior to that time. The duty of water is different in different parts of the country, and in fact is different in different sections of the Provo Irrigation or drainage district. During the early part of the season it ranges from a fifty acre duty to an eighty acre duty eighty acres of the very best land, deep soils, uniform soils; in the latter part of the season, after the 20th of July, it runs from a sixty acre duty to one hundred and twenty acre duty, sixty acre on the porous lands and shallow lands, one hundred and twenty acre duty on the better soils and better types of soils. I know that it is the habit or

custom or nature of farmers to always want more water. I have never studied agronomy.

(Tr. 116:)

Q. Did I understand you to say that during the low water period you were limited to fifteen second feet from the Snake Creek District?

(Tr. 117:)

A. No, that is from the river; eight second feet from the Upper Canal and about seven second feet through the Island Ditch.

Q. Giving you a total quantity of how much in the Snake Creek drainage or Midway Irrigation District during the low water period?

A. On each of these dates?

Q. No, I simply want to clear up that fifteen second feet, that is all.

A. It would be an average of about forty-eight second feet, total.

Dry farming in this country means the raising of crops without irrigation—dependent upon the moisture in the soil and the precipitation, either snow or rain.

Q. When did that first come into vogue or effect in this state?

56 Mr. Wedgwood: If your Honor please, I think I will object. I don't think any order of court is necessary to force us to dry farming. I don't see how it pertains to this case. If we desired to dry farm we wouldn't be in this lawsuit. It is not cross-examination. I don't want to be captious about that I want to give them every chance to get from the witness anything that pertains to the case. If counsel will explain the object maybe I will withdraw the objection.

Mr. MacMillan: I will tell you the purpose of it. The purpose is simply this, if the court please, [*you*] Honor will find when counsel comes to argue this case, that he will make a most eloquent argument as to the necessity of irrigation in mountainous country in the State of Utah, in order to grow crops, in order to persuade the court to cut loose from the common law doctrine, which we claim is applicable in this case, and to show the reason why, if that is the rule of law in this state, that your Honor should now establish a new rule of law, and hold that the common law doctrine is not applicable. In a brief that was filed in the former trial, which was a very lengthy brief, I imagine there were ten or fifteen pages devoted by General Wedgwood to the description of the manner of carrying on farming in this community and the necessity of using water from the streams to irrigate the crops for the purpose of differentiating conditions in the State of Utah, from states like the central states or New York and various other states where crops are grown without the use of water applied in the regular irrigation system.

The Court: I will say to both of you gentlemen, my present impression is—of course, I may be wrong after argument—but with

the admission that you have made, if counsel for the defendant makes a similar admission with respect to the needs of the reservoir company, that as far as this court is concerned, that question could be eliminated. In other words, as I understand from your admission made a moment ago, you do not propose to contest with respect to the necessity of the use of all the water that you have had heretofore, even including that that flows from these tunnels, and I assume that probably counsel for the defendant will admit that the reservoir company needs all the water it could get.

General Wedgwood: May I make an observation in there. Of course, if it gets to that stage of the game, why I shall not only contend but I will demonstrate that if the Provo Reservoir Company have any rights, their rights are better subserved by putting this water on this land up here than to take it off the land and turn it down the river, that is, that they get more water I am pre-
57 pared to demonstrate; it is not a question of guess work but
demonstration, that they get more water.

The Court: I understand that theory exists, but, nevertheless, I take it really the question in this case is not the necessity of these lands under the system of irrigation, the need of this water; the real question in this case is whose water this particular water in litigation is under the law and the facts.

Mr. MacMillan: That is our position in the matter.

The Court: In other words, I understand the issue in this case to be on the one hand you claim that this water that has been developed or found in the tunnel is what might be termed "new water," on the other hand you claim that water is simply intercepted in the tunnel, that it has heretofore found its way to Midway, and therefore the water was your water inasmuch as it now finds its way through the tunnel where otherwise it found its way through the soil; you claim it has nothing to do with the natural flow of the stream in the tunnel; possibly added to that the theory that under the common law that being percolating waters you would have a right to it.

Mr. MacMillan: I think with the last addition your Honor has stated our position.

The Court: You gentlemen could take, of course, for the purpose of making this record, all the time you desire, in proving the necessity and so forth, but from my view of it finally, it seems to me the issues must be as I have stated them.

Mr. MacMillan: The only reason, if your Honor please, that I cross-examine the witness at all upon this question is, as of course is readily apparent to your Honor and every one else, that the witness uses this necessity as a foundation for the opinion which he has given that there could not have been any more water prior to 1914 than there was in the subsequent years.

The Court: It has a bearing for that purpose.

General Wedgwood: If the court will pardon me just a minute, of course, your Honor is absolutely right; the ultimate question on which this case will be decided will arise just as you have stated, but some of us, perhaps, as our years of experience roll around, and

decisions come from courts of last resort, find that the things which we deemed of absolutely no importance, are the mountains from which everything rises in the decision.

58 The Court: For that reason I have suggested that for the purposes of this court I shall keep my mind directed upon the questions as I view them, but for the purpose of making this record, I am not inclined to limit you as to anything you claim on either side as bearing on the question.

General Wedgwood: I feel keenly my responsibility in this case because if there should be taken away thirteen or fourteen cubic feet of water per second, I think that proportion of homes in that country would have to be abandoned and of course, it makes me anxious to make a record to embrace everything.

The Court: Well, gentlemen, you may proceed and make your records, keeping in mind the view which the court now has, if you agree with that view as to the ultimate question, make such record as you feel you ought to make for the purpose of review in another court, and I am not inclined to limit you in that respect on either side, and for that reason, if you claim anything for the question that you have asked, he may answer.

By Mr. McMillan:

Q. The question was when did that first come into vogue in the State of Utah, dry farming?

A. About 1897 or 1898.

Witness, continuing: And since that time the acreage of so-called dry farming has greatly increased in Utah and good crops harvested in that manner.

Where the users get a less quantity than this 55 acre duty, they do not get over their system; they do not make their irrigations; they leave out a part of their lands. In 1915 we did not get over the whole Midway system. I am not able to tell how much of the land they were unable to cover. I base my statement on the fact of noticing that a field, or a part of a field, was not irrigated and they did not get a second crop of hay. I could not say what years I have noticed this, but I have noticed it on the lands immediately above the town of Midway.

The outside red line upon Exhibits 1 limits the so-called Snake Creek drainage area, and the red lines running in various directions inside represents ridges running in the direction of those lines. The area of that water shed is 25 square miles; 15,000 acres.

59 The yellow portions running in various directions in the district represents the bottom of the canyons, gulches and creeks.

The representation of Snake Creek tunnel from Clayton Peak to the joint marked "18000" is merely a projection of my own. I do not know what the facts are with respect to that. The line is shaded in white up to 10,600 feet and from that on, the 18,000 feet is just a projection.

I have never observed any waste of water over Midway Irrigation system.

Alfred L. Alder, a witness produced by the defendant, testified in substance, as follows:

I am 43 years old. I was born and raised at Midway and have lived there continuously except during the years 1911 and 1912. I was brought up as a farmer and have been engaged in the cultivation of land for thirty or thirty-three years back at Midway.

My recollection of Midway goes back twenty-seven or twenty-eight years. It has not increased in population in the last twenty years. Occasionally houses have been built and the old ones torn down, but the general community has not increased for twenty years. Twenty years ago we were cultivating the same ground we are cultivating today, other than perhaps two or three odd acres which may have been broken along the hillside. The lands as they lie today under the irrigation system were irrigated prior to 1910.

As to my recollection as to whether or not the lands were better irrigated prior to 1913 or thereabouts, I remember my experience as a boy irrigating with my father for a chain of years. We must have had more water for we could leave our water and sleep a while at nights. Today, as I water my farm I must stand by the ditch every hour if I cover the ground in the low water season. I have never seen any crops raised in Midway without irrigation. It is a fact that the waters are used day and night throughout the twenty-four hours. We have a ticket according to our holdings and it makes no difference what time in the night it comes, we take the water and turn it on the ground.

During all the years prior to 1913, good crops have been grown upon the lands under the Midway system. Our crops are materially shorter now than they were in my earlier recollection. My
60 experience teaches me that this difference in the crops is caused by our water turns being too far apart. Turns come every twenty-one to twenty-five days. Turns do not come around oftener because there is but a small supply of water to satisfy this large amount of ground. I do not remember of seeing our crops suffer in my earlier recollections through lack of moisture.

Our crops are mostly hay and grain. Alfalfa, Timothy and Clover. Wheat and oats are our main grain crops. That has been true practically throughout the history of Midway and cultivation is practically confined to these crops on account of the high altitude. Prior to 1913 my judgment would be that seventy-five per cent of the lands were in hay and twenty-five per cent in grain.

I am a stockholder of the Midway Irrigation Company.

Cross-examination:

Water is distributed in accordance with the holding of shares of stock in the corporation. If a man has one hundred shares of stock he is entitled to one stream of water for 200 hours, two hours to the

acre. It varies proportionately with the number of shares he has. Some ditches try to irrigate on an hour and a half in order to get the water often. It is my judgment that not to exceed twenty additional acres has been brought under cultivation during the last twenty years.

During all the years prior to 1913 we produced good crops in that district in the general run; we had two short years before that that I recollect, along in the 90s, when the entire western section of our country suffered with drought, and the year when the Ontario tunnel caved; we were cut off from that water and felt quite a material shortage, and in 1913 when they flowed this water we had been using away from us.

I would say that in 1914, 1915 and 1916 the crops were materially short compared with the years back and that that shortage was induced by shortage of water.

I think the driving of the tunnels was effective in causing that shortage. My lifetime experience on the creek and seeing it take the change itself has led me to believe the tunnel drained our system and left us no reserve for late season. I think that the greater factor was the tunnel; the lesser perhaps has been variation in precipation. Prior to the construction of the tunnels I never made any measurements of the water, nor saw any made. My
61 opinion as to the shortgage of water is, in comparison with former years, based upon my experience and recollection.

When I refer to the shortage of water I refer to the low water season of the year.

During the season of 1917 I suffered the latter part of the season for lack of water, for the reason I was put too far apart between my waterings, on account of lack of supply. I could not see much difference between that year and 1916, nor do I recollect any material difference between 1914 and 1915.

I do not think that during 1914 we had a normal supply of water as compared to years prior to the time the Mountain Lake tunnel was constructed. Comparing the years from 1902 to 1914 with prior years I would say there was several second feet difference; anywhere from six to twelve second feet shortage. The most material shortage has been in the last four to five years I think. I am comparing with the years prior to the running of the tunnel that embraces the years of my early recollection, except the drought year, but I would not confine myself to any one or two years in this testimony.

It is my opinion that taking a period of time from 1897 down to 1904, that the water was from six to twelve feet in excess of the average from about 1910 down to 1914. When the Snake Creek tunnel struck that water there seemed to be a rush and gush of water, the flume was booming; the creek was not materially changed to such a noticeable degree; it was not a great while until that flush seemed to pass by. I did not notice the shortage in the water supply from the time the Mountain Lake tunnel struck its big flow down to the time the Snake Creek tunnel was started. I would say the cause of the trouble was the Snake Creek tunnel.

Caleb Tanner, a witness produced by the defendant, testified in substance as follows:

I have resided at Provo, Utah, forty-eight years. I have made a study of artificial irrigation. My profession for the last eighteen or twenty years has been that of an irrigation engineer, mainly in Utah and also in portions of southern Nevada, and southern Idaho. I was in the service of the United States Government for a period of years and was State Engineer of Utah for eight years. I was brought up on an irrigated farm which derived its water from the Provo River.

62 I have made extensive investigations as to the soil character in most of the drainage area of the Provo River but my investigations in Wasatch County were not as detailed as in Utah valley.

These investigations were made with reference to a case pending; the Provo Reservoir Company vs. Provo City. The evidence in that case involved practically the whole stretch of the river, or seventy miles, from its head waters to Utah Lake and involved part of the Midway land. I am inclined to think that the quantities involved took into consideration the flow of Snake Creek. I know the lands in the Midway Irrigation system in a general way. I do not know of crops being grown on those lands without irrigation.

It is not uncommon in this state for communities to develop to a certain size and there remain without change. The water supply is the controlling element in such cases. If the quantity of water which an irrigated district has had for the last four years is actually known, and that amount is barely sufficient to maintain a cultivated and tillable condition, and it is satisfactorily shown that a cultivated and tillable condition had been maintained for twenty, thirty or forty years back, it necessarily follows in my judgment that they must have had as much, if not more water, during the earlier years as they have now when the quantity is known.

I agree with Mr. Wentz, that strictly speaking, there is no fixed duty of water where you have not an available supply throughout the season.

There are some prior rights on the Provo River system that have a sufficient available supply, but on the great bulk of the irrigated land, the users must conform in their irrigation to the fluctuations of the flow one year with another and at different times during the same year. Even where there is a dependable supply, it is advisable and beneficial to supply a greater quantity of water in the early part of the season than in the latter part. The practical necessity is larger in the beginning of the irrigation season than later.

Although the Midway area is dissimilar in chemical composition to other areas in the Provo River drainage system it is comparable so far as irrigation necessity is concerned with the other areas.

63 In my judgment from 80 to 110 acres per second foot is a very high duty for the lands in the Midway system. I would not expect those lands to be served with that duty. In my judgment this land could not be properly served and produce standard agricultural crops at a duty greater than about 70 acres per sec-

ond foot net. The lands very commonly are thin lands; the soi under the system that are in the pot rock area are very shallow; the are irregular in their surface contour and somewhat difficult to di tribute the water over. You cannot cure this disadvantage withou ruining the elevated portions of your field, scraping off the soil tha is there. It is an area of relatively high difficulty to make perfe so far as the surface is concerned for the operation of an irrigatio system most economically.

My judgment would be that the loss in the canals that carry wate from the natural channels to the irrigated lands would be approxi mately fifteen per cent. With a net duty of 70 as I stated, the dut at the headgate would be approximately 60. The earlier irrigation ought to be in greater quantity than this.

I would say that for the first forty or forty-five days of the irriga tion period, down to the completion of the irrigation of grain crops the duty should be 60 acres net to the second foot. Considering th figures given me, a duty of from 80 to 110 acres per second foot an comparing it with any other system whose appropriations relate bac twenty years, this is the highest duty that I can now recall on th Provo River drainage areas.

Cross-examination:

Land requires more water in the earlier part of the season becaus on the first irrigation water goes over plowed land very slowly; ther is a great practical difficulty in spreading the water over the surface In the areas that have fixed crops on their surface in the winter sea son, the ground is affected by frost and relatively open and the firs irrigations take very much more water as a matter of practical flow age over the surface than the later irrigations do. The early par of the season would be about the first forty days.

Redirect examination:

When the term "duty of water" is used, it is meant that a given quantity of land, acreage is served by a given q-antity of water flow- ing on it. If you do not have water you cannot have a "duty of water" any more than you can have a duty if you do not have
64 the land. You can modify the duty as the season progresses month by month, or week by week, by putting on a different quantity of wtaer at the different times and this is loosely spoken of as a "duty."

STERLING TALMAGE, a witness produced by the defendant, testified in substance as follows:

I reside in Salt Lake City and I am acquainted in Snake Creek canyon. I was last there in October 1917. I took the photograph marked "Exhibit 100." I have marked the point where these photo- graphs were taken upon Exhibit 1-A by a cross and "photo, Exhibit 100." This point is near the road up Snake Creek Canyon proper, below the group of buildings near the mouth of Lavina Creek, prac- tically in line with the general course of Lavina Creek. It would

be near the northwest corner of the southwest quarter, Section 17, Township 3, Range 4, east, as shown upon the map.

Exhibit 100 consists of three photographs taken from the same point on the same day in succession, at approximately the same time. The [Trip-d] of the camera was not moved in taking the three. I have marked 1, 2 and 3 on the panels of the composite photographs, that being the order in which they were taken. When No. 1 was taken the axis of the camera pointed north 59 degrees west; No. 2, north 36 degrees west and No. 3 north 2 degrees east.

The canyon shown near the center of the background of No. 1 is called the left fork of Snake Creek; that shown in the center of the picture, taking in part of the right hand portion of Section 1 and the left hand portion of Section 2 is called Snake Creek canyon and that occupying the central portion of 3 is Lavina Creek Canyon.

Defendants' Exhibit 100 received in evidence.

Frank Wentz, recalled by the defendants for further direct examination, testified in substance, as follows:

I prepared Exhibits 1 and 1-A myself from plats of land and mineral surveys in the Surveyor General's Office, which are public records. I have stated that the red represents the crest, hills or mountains or the divides. The exterior crest of the ridge of the Snake Creek drainage area as shown on Exhibit 1 is described as follows:

65 Beginning at the southwest corner of Section 19, Township 3 south, Range 4 east, Salt Lake Meridian, thence in a northwesterly direction, for a distance of approximately three miles to a point opposite the head of Snake Creek proper, thence in a northeasterly direction and northerly direction to Clayton Peak, marked "Clayton Peak" on Exhibit, thence in a northerly direction to a point near the center of Section 36, of Township 2 south, Range 3 east, thence in a northeasterly direction to the quarter corner on the west side of Section 30, Township 2 south, Range 4 east, thence in an easterly direction through Section 30, southerly direction to the quarter corner on the south side of Section 32, and along near the center line of the north half of Section 3 and along the dividing line between the north half of Section 34, of the township, to a point a little east of the east side of Section 34, thence in a southwesterly direction to a point near the quarter corner on the west side of Section 3, Township 3 South, Range 4 East, thence in a southeasterly direction to a point near the quarter corner, on the south side of Section 3, thence in a southerly direction to the east half of Section 10 and Section 15, thence to a point about in the center of the north line of the northeast quarter of Section 22. That is as far as this line is shown on Exhibit 1. It is shown to a further extent on Exhibit 1-A and the line as I have thus described it is also shown on Exhibit 1-A. Continuing the description upon Exhibit 1-A, from a point on the north line of Section 22, Township 3 south, 4 East, thence in a southwesterly direction to a point near the quarter corner

on the south side of Section 22; this is the east side of the mouth of the canyon and the mouth of the canyon is approximately one-half mile wide. Then beginning at the point shown in the northeast quarter of Section 28, of the same Township and thence in a westerly direction and a northwesterly direction past the northwest corner of Section 29, thence westerly to the southwest corner of Section 19, the place of beginning.

The road from Midway is shown by a double line extending a short distance north of Midway, thence west through Section 24, thence north through Sections 24 and 27, thence in a northwesterly direction to the mouth of Snake Creek tunnel and then it substantially follows the course of Snake Creek proper up the canyon.

I took the photograph marked "Defendants' Exhibit 101" on May 23rd, 1918. It was taken from the turn in the road shown on Exhibit 1-A, which is marked "A" in the northwest corner of
66 Section 22 at the mouth of the canyon, "Pho. 101." The axis of the camera pointing north 40 degrees west which course deviates approximately five degrees from the course of the tunnel as shown upon Exhibit 1-A. Practically I was looking exactly as the tunnel points.

With reference to the territory shown upon Exhibit 1 and Exhibit 1-A, it shows the main canyon at the head, and the head of the Snake Creek drainage area.

Defendants' Exhibit 101 received in evidence.

Commencing at the right on Exhibit 1, the first yellow line terminating in the south boundary of section 22, is White Pine Creek, a tributary of Snake Creek in the Snake Creek drainage area. It runs from the south boundary of section 22, township 3, range 4 east for approximately three miles in a northwesterly direction and then takes a more northwesterly direction through Section 4 and up near the center of Section 2, Township 2, Range 4 East, then in a westerly direction and heading near Clayton Peak as marked on the map. There are branches in that canyon; a number of forks, shown on the plat in yellow. In section 32 the main creek runs westerly to the quarter corner on the west side of Section 31, it forks again and runs in two branches near Clayton Peak; the other fork in Section 32 runs in a southwesterly direction, heading in three lakes known as Day, Brimhall and Highland lakes. These lakes are marked upon the plat. There is a fourth representation there marked "reservoir" which is artificial.

I took the photograph, defendants' Exhibit 102, on May 23rd, 1918. It was taken from the same point that is marked "A" on Exhibit 1-A, near the mouth of the canyon, as Exhibit 101 and which is [mark-] in pencil "Photo 102." This exhibit shows the country, including White Pine Creek and the adjacent country from the same point that Snake Creek is shown. The axis of the camera pointed almost due north.

Plaintiff's Exhibit 102 received in evidence.

White Pine Creek is an intermittent stream. It does not flow in the late summer and fall.. There is no water coming in the latter

part of the irrigation season. I measured the flow of this creek May 24th, 1918, just above its junction with Snake Creek. I mark the point of measurement upon Exhibit 1-A with a pencil line across the creek May 18, 1918. The volume of water was 8.34 second feet.

67 Mahogany Springs augments the flow of Snake Creek, if not artificially diverted. I have shown by a cross on Exhibit 1-A, near the quarter corner on the east side of Section 21 and opposite this marked, "Mahogany Springs." On May 24th, 1918, I measured the total flow of these springs and found it to be 9.02 cubic feet per second.

The next drainage area within the Snake Creek area to the west of Pine Creek is Lavina Creek, which joins the main Snake Creek near the quarter corner between Sections 17 and 18, Township 3, South, Range 4 East.

I took the photographs marked "Defendants' Exhibit 103" on May 24th, 1918. I indicate the point at which it was taken on Exhibit 1-A by "Pho. 103". I was looking practically north. On the right the photograph shows Lavina Creek canyon and on the left the divide between Lavina and Snake Creeks. The nose or the left is the divide and the "V" shaped depression on the right, higher up, is the bulch of Lavina Creek.

Defendants' Exhibit 103 introduced in evidence.

For a distance of about three-quarters of a mile from where Lavina Creek intersects with Snake Creek, up to the gulch, the slope is relatively less than the balance of the way. The bottom would average approximately one per cent grade, but both sides of the canyon rise very steeply on each side to the dividing ridges which are very high. From that point the canyon gets steeper and rises up near the vicinity of Clayton Peak, very steep all the way, and very deep except at the head where it flattens out.

This canyon flows a stream of water throughout the year. I have measured it at different times at the weir, above the confluence at Lavina Creek with Snake Creek. I have indicated the place on Exhibit 1-A by "weir" in a pencil line across Lavina Creek. My measurements were as follows:

August 21, 1914, 8.36 second feet; November 16, 1914, 4.46 second feet; November 18, 1914, 4.39 second feet; February 23, 1915, 3.42 second feet; April 19, 1915, 2.94 second feet; May 23, 1918, 4.19 second feet and May 24, 1918, 4.19 second feet.

The divide between the White Pine drainage area and the Lavina Creek drainage area is high and broken up with several spurs and is shown by the hatched line on Exhibit 1-A and by the red on Exhibit 1.

68 The next canyon or water course to the left, or west, is Caribou Creek. Caribou Creek joins the main channel of Snake Creek as shown upon the map, in the southwest quarter of Section 7, Township 3 South, Range 4 East, and runs in a north-

westerly direction, heading a little south of Clayton Peak at a poin marked "Caribou Springs" in Exhibit 1 and Exhibit 1-A.

This gulch is a tributary to Snake Creek. In November, 191 Caribou Springs were flowing a small stream of running water. did not follow the stream down to know how far it flowed. The roa that follows the main channel in Snake Creek, up the canyon, heret fore spoken of, is on the west side of the creek to a point near th portal of the Snake Creek tunnel. There it crosses to the east sid and follows up the main creek. It also crosses Caribou gulch ju above its junction with Snake Creek and goes on up to the Mountai Lake tunnel shown on exhibit 1-A in the extreme left on the ma marked "Mountain Lake Tunnel."

On May 23rd, 1918, Caribou gulch where it crosses the road r ferred to was dry, and there was still snow in the canyon that w visited.

I took the photograph marked "Defendants' Exhibit 104" on Ma 23rd, 1918, at the point I marked on Exhibit 1-A "Photo 104". I was taken from the north side of the canyon, approximately one half mile below the Mountain Lake tunnel, and looking north 6 degrees west towards the head of the Snake Creek canyon.

In my judgment Caribou Springs is higher in elevation than th Mountain Lake tunnel, but I could not say how much.

The building shown on the right hand side of the depression, an around which I mark a circle in pencil on Exhibit 104, is the build ing near the mouth of the Mountain Lake tunnel. This photograp shows the head of Snake Creek and the conditions existing ther relative to the snow, and also the heights of the broken up country On May 23rd and 24th the snow was melting and considerable snow water was coming down. This photograph correctly represents tha canyon terminating in an almost abrupt granite wall on all sides

Defendants' Exhibit 104 received in evidence.

I took the photograph marked "Defendants' Exhibit 105" on May 24th, 1918. It was taken from the same point as Exhibit 103, and is marked on Exhibit 1-A "Pho. 105". The axis of the camera was a little more west than the tunnel, looking up Snake Creek.
69 It was taken at a point about two and one-half miles below the point where Exhibit 104 was taken.

I have known of water running out of the Mountain Lake tun- nel since 1914. I have made measurements of its flow. They were made near the mouth of the tunnel approximately 30 feet in from the portal. On August 21st, 1914, I found 8.50 second feet; Novem- ber 17th, 1914, 4.89 second feet; May 23rd, 1918, 3.70 second feet.

The next substantial canyon to the west is the left fork of Snake Creek which joins the main Snake Creek channel near the portal of the Snake Creek tunnel. I measured the flow of the stream in that canyon on May 23rd, 1918, and found it to be 0.42 second feet. This measurement was made about 200 or 250 feet above the dump of the Snake Creek tunnel and which I marked on the map by a large cross.

I took the photograph marked "Exhibit 106" on May 24th, 1918,

from the same point that photos 103 and 105, which I also mark on the map "Pho. 106", were taken. It represents the left hand fork of Snake Creek, the topography of the country and the gulleys and hills.

Defendants' Exhibits 105 and 106 received in evidence.

The canyon from which Twist Springs flow joins the main creek channel below the portal of the tunnel, and near where the buildings of the Snake Creek tunnel Company are situate. They are shown on Exhibit 101 as is also the tunnel dump, in light color.

Twist Springs canyon is marked upon the map going in a westerly direction to a point just below the tunnel portal, and practically opposite the junction of Lavina Creek. There is a small stream there that I have never seen dry, but have never measured it independently.

The next canyon substantially south is Bonar Hollow. It does not carry a perennial stream. There was a very small quantity of water there on May 23d; .05 of a second foot.

Gerber Spring is still south of Bonar Hollow, at a point I mark "Gerber Spring", in the southeast quarter of Section 21, Township 3 South, Range 4 East, on Exhibit 1-A. It is about two and one-half miles down the canyon from the portal of the tunnel.

Springer Spring is located and shown on Exhibit 1-A by a cross and the words "Springer Springs", near the northwest cor-
70 ner of Section 21, Township 3 South, Range 4 East. I
measured it on May 24th, 1918, and found 1.95 second feet. The characteristics of the country at the exit of Springer Springs resemble those of Mahogany Spring. The Springer Spring comes out near the bottom of the slope, from the side of the canyon, at the lower end of a ridge dividing two small canyons. Gerber Springs also comes out right at the base of the hill. Part of Gerber Spring is a tributary to Snake Creek and a portion is diverted into a pipeline for the municipal use of Midway.

The different hollows and water courses on the left side of Exhibit 1-A, and on the west side of Snake Creek proper, are separated one from the other by high irregular ridges and steep slopes of mountains.

From what I have designated as the mouth of the canyon, shown by the break in the red lines enclosing the area I have described on Exhibit 1-A, the length of that area, its longest distance northwesterly is a little more than six miles. I think the rise of the country for the next six miles up to the head of Snake Creek, near the Mountain Lake tunnel as shown on the plat, and on Exhibit 104, is approximately 4,000 feet, which would be a rise of about 660 feet to the mile.

The width of the area circumscribed by the red lines on Exhibit 1-A, as indicated to be the transit area of Snake Creek, east and west is approximately six miles, maximum.

In going up the road along Snake Creek, above the junction of Lavina Creek, you pass certain tributaries to Snake Creek. I last saw them on May 23rd, 1918. Carbioo Creek was dry. The first

hollow above Cariboo Creek was flowing approximately .30 of a second foot. The hollow marked on the map "Spring Branch" was flowing approximately .50 of a second foot and the small hollow a short distance below the Mountain Lake tunnel approximately .60 of a second foot. I did not observe any tributaries on the south side. The total of these inflows as I noticed them was 1.4 second feet.

I observed box culverts across the road about one-half mile below the Mountain Lake Tunnel where I have marked three lines on Exhibit 1 across the line of Snake Creek and at the left have written "Culvert". They form a box of approximately a foot square in size and drain across the road and are approximately 200 feet apart. The country now is perfectly dry there.

At the point near the road crossing and about 200 feet north from the portal of the tunnel which I mark "B", I made a measure-
71 ment of Snake Creek on May 24th, 1918, at 4:15 P. M. The stream was high and roily. The flow was 11.28 second feet which was 6.18 second feet above the observed surface flow into Snake Creek above that point. The small streams between the Snake Creek tunnel and the Mountain Lake tunnel flowed 1.40 second feet; the Mountain Lake tunnel 3.7 second feet, which makes 5.1 which deducted from 11.28 leaves a balance of 6.18 second feet. I think that was all practically snow water.

I have made other measurements of Snake Creek at substantially the same places. On February 23rd, 1915, I found 2.90 second feet; on April 19th, 1918, 3.17 second feet; May 24, 1918, 11.28 second feet.

I took the photograph marked "Exhibit 107" at a point in the main bed of Snake Creek channel, opposite the mouth of Lavina Creek canyon, looking directly into the face of the east side of the gulch. It was taken May 24th, 1919.

I also took the photograph marked "Defendants' Exhibit 108" on the same day at a point about 100 feet further down the creek on Exhibit 7 marked on the plat Exhibit 1-A "Pho. 107." It was taken looking down on the bottom of the creek showing the wash in the creek bed. Exhibits 107 and 108 received in evidence.

All the territory within the divide marked with the red line represents the Snake Creek area drains to the point where the break is at the mouth of the canyon, and across which I write in pencil "mouth."

All of the ditches shown on Exhibit 1, lying south and east and west of this mouth are the ditches of the Midway Irrigation Company. There are some diversions further down the channel that are not shown upon the map.

Commencing with my first measurement I found the aggregate flow from the Snake Creek drainage area to the Midway Irrigation Company to be:

July 16, 1914, 39.31 second feet; August 28, 1914, 30.10 second feet; September 18, 1914, 31.52 second feet; November 16, 1914, 28.48 second feet; May 11, 1915, 33.10 second feet; May 28, 1915, 39.07 second feet; June 11, 1915, 40.26 second feet; July 31, 1915, 25.02 second feet; August 21, 1915, 33.63 second feet; May 6, 1916, 46.95 second feet; May 13, 1916, 42.17 second feet; July 7, 1916,

31.69 second feet; August 13, 1916, 22.41 second feet and
72 June 7, 1917, 86.65 second feet. As to the last measurement, my note is as follows: "Large flow from Pine Creek."

This is dated June 7, 1917, is the the peak of the high water flow of the Provo River for a period of years from 1905 to 1916 inclusive. That is the highest flow of the Provo River.

June 30, 1917, 46.30 second feet; September 29, 1917, 37.17 second feet; April 19, 1918, 28.32 second feet and May 24, 1918, 43.20 second feet.

I made these measurements in the performance of my duty as a commissioner of the district court of Utah County in making the distribution of the waters of that water shed. The waters I measured were used on the lands of the Midway Irrigation Company.

There is a power plant in Snake Creek canyon 6,000 feet north of the orifice of the canyon. The waters of Snake Creek and Lavina Creek and from the tunnels propel the wheel. I do not know whether or not that power plant was constructed and in operation before the Snake Creek tunnel was commenced.

Mr. Wedgwood: Any objections to admitting that fact, gentlemen?

Mr. MacMillan: We will admit it was running before the water was brought out of the tunnel.

The Witness: The confluence of Lavina Creek with Snake Creek is above the power plant. The rise of the country as you go northward from the mouth of the tunnel is steeper than below. It is steeper from the power plant up to the head of the pipeline than it is below the power plant.

Speaking generally, the floor of the basin between the divides up to the power plant is approximately a level area from one side of the canyon to the other. It is what is known as a refilled canyon. It is also a refilled canyon from the power plant up to the forebay, flat in the bottom of the gulch, gradually narrowing as you go up. As you go up above the confluence of Lavina Creek and Snake Creek, as I say, the elevation rises very much faster and the canyon floor is very much narrower. After you pass the flat on which the buildings of the Snake Creek Tunnel Company are situated, it is very narrow, just a few feet across. Generally speaking, those canyons are refilled canyons above there, bed rock is exposed in Snake Creek canyon above there in places. Immediately below the Mountain Lake tunnel bed rock is exposed. I do not recall the condition of Lavina Creek.

73 I made my first measurement of the waters flowing from the Snake Creek tunnel on August 21st, 1914, and found the discharge to be 8.36 second feet. I made another measurement on February 23rd, 1915, and found the discharge from the tunnel to be 16.20 second feet. During the months that had elapsed from the first measurements, the discharge was approximately doubled. I made other measurements. On July 17, 1918, I found 13.83 and on May 24, 1918, 13.44 second feet flowing.

The measurements I have heretofore given and referred to as measurements of water to the Midway Irrigation Company included

all the waters coming from the Snake Creek water shed, includin the waters from the Snake Creek tunnel and Mountain Lake tunne

In the year 1918 the tunnel measurements were made on th same day that I made measurements of the combined flow of Snak Creek. Deducting the flow of the tunnel from the combined flo of all the water courses at the time of the measurements, the balanc of the flow on April 9th was 14.9 and on May 24th, 19.76 secon feet. They were using water for irrigation this year in April. made measurements of the total flow of Snake Creek in Augus 1914, and also of the tunnel flow. Deducting the amount of th tunnel flow from the total flow, there would remain 21.74 second fee

I was in the Snake Creek tunnel in February, 1915. I observe the flows of water in different places during the two miles of it length. I have my notes of the observations I made of water com ing into the tunnel—they are;

At the 1,400 foot point tunnel sweating on the roof; 1,720, ther is a flow and a drip and the pipe at this point flowing approximatel .05 of a second foot; Point 2,994 dripping water through concret lining; 3,700 the point called the first drip; 4,000, end of first drip 4,066, small stream from the left side, approximately .10 of a secon foot; 4,100 stream from the right, approximately .05 of a second foot 4,120, stream from left, approximately .05 of a second foot; at 4,51 small stream on bottom of tunnel at the left side of approximatel .15 of a second foot. Also a small stream from the right; 4,68 small stream from the left; 5,080 small stream from the left, ap proximately .05 of a second foot; 5,150 was a drip; at 5,154 drip o the right, 5,470 flow from the right of approximately .10 of a secon foot; 5,510 stream from the left of approximately .20 of a secon foot; 5,570 stream from the left of approximately .05 of
74 second foot; 5,800 stream from the left .05 of a second foot 5,900 to 5,950 dripping; 6,440 water from both sides; 6,75 a small quantity of water coming in; 7,050 a small flow; 7,100 stream of .05 of a second foot, coming from the left; 7,310 first en of dripping section; 7,320 water flowing from the left base of ap proximately .10 of a second foot; 7,400 a small flow at the base 7,575 a very small stream, just seeping; 7,600, flow from the wes at the floor of approximately a quarter of a second foot; 7,660 smal stream at the base at the left, just a seeping stream, not a flowin stream; 7,725, small seep at the base; 7,750 to 7,800 seeping on both sides; 7,800 a stream coming from the left of approximately .10 of a second foot; 8,000 dripping; 8,060 a wet opening in the tunnel 8,130 the opening in the rocks is wet; same at 8,150; 8,225 some water coming in at base on the east side seeping; 8,270 to 8,37 dripping; 8,400 a small seep; 8,464 the opening in the rock wa wet; 9,200 and 9,260 dripping; 9,325 a stream on the left of .10 o a second foot; 9,435 to 9,500 a light drip; 9,580 a small stream fron the left of approximately .10 of a second foot, with a seep on th right; 9,785 a stream from the left of approximately .15 of a second foot; 10,193 to the face 10,600, the water pouring into the tunnel estimated at six second feet.

The next morning, February [22rd], there was a measurement

made at a point 417 feet from the face of the tunnel and 6.87 second feet gathered within that 417 feet. Deducting that amount from 16.20, the total flow of the tunnel, and there remains 9.33 second feet.

In going into the tunnel I made the estimates I have given you. At points I mentioned water but did not give an estimate flow, the quantity was too small to estimate. The aggregate of the different flows I estimated is 1.70 second feet. Deducting same from the remainder, after deducting the flow at 417 feet from the face of the tunnel, leaves 7.63 second feet. I did not see how that 7.63 second feet of water got into the tunnel, it was invisible and got in somewhere between 417 feet from the face and the orifice.

Exhibit 22 is a hydrograph of Snake Creek tunnel, showing the discharge from the tunnel at the different stages of construction, and also the dates, from the portal of the tunnel to approximately 10,600 feet. That hydrograph does not show the conditions as they existed at the time I was in the tunnel and made the measurements referred to, 417 feet from the face, but it takes them nearly up to that point.

The point where I found my first water flowing was at Station
1,720. The date that point was passed is marked on Exhibit
75 1, November 1, 1910. The hydrograph Exhibit 22 does not
show any water there. The next point I referred to was at
2,994 where the tunnel was dripping. That was passed about March 1, 1911. The hydrograph shows a flow of water there of approximately .05 of a second foot, the same as I estimated it.

The next point I have as to date as shown by the hydrograph is 4,066, near September 1, 1911. My estimate of water flowing there was .10 of a second foot. The hydrograph shows at that point nearly five second feet had flowed out. The hydrograph shows that from the point where I estimated a flow of .05 of second foot, that during the six months that elapsed between March 1st and September 1st, 1911, the flow previous to May 1st ran up to nearly .2 of a second foot, then increased to 5.2 second feet; then decreased in the curved line to July 1, 1911, to three second feet and continued to decrease down to a point previous to September 1, 1911, to a discharge of .40 cubic feet and then increasing abruptly to just before September 1st to a discharge of practically five second feet. From .4 to five second feet on that day.

In going into the tunnel that distance I made notes of seams, cracks or openings that were dry and all I found in that distance was two flows; one of .10 and one of .05 of a second foot. I found my next flow at 4,100. It is a short distance after the date of September 1, 1911 on the hydrograph. My estimate of what was flowing there was .65 of a second foot. As shown by the hydrograph, at the time the tunnel was opened to that point 4.8 second feet was flowing. I found my next flow at 4,120. I found .05 of a second foot flowing there. Approximately 4.8 second feet was flowing at the time the tunnel was driven past that point. The next flow I found sufficient to estimate was a 4,515.

Mr. Wedgwood: May we have an admission that going horizontally across Exhibit 22, hydrograph of Snake Creek tunnel, the space between the vertical lines represents six days.

Mr. MacMillan: Six days for each little block.

The Witness: The tunnel passed that point near May 6, 191 and at the time that point was reached was flowing five second fe I found .15 of a second foot. Substantially five second feet runnii out of the tunnel from September 1, 1911 until the first part of Ma 1912; a continuous flow of five second feet for approximately eig months where I found these small flows visible.

76 I found my next flow at 5,080. That point was reache about August 1, 1912. I found .05 of a second foot flowin there. At the time the tunnel passed that point there was 9.2 second feet flowing. The flow from the tunnel as shown by th hydrograph between May and August 1, 1912 had run from approxi mately 5.8 second feet up to 9.25 second feet. I found my ne estimated flow at 5,470. The tunnel passed that point about No vember 1, 1912. I found to be visible flowing there, .10 of a secon foot. At the time the tunnel passed that point there was a littl more than 14 second feet flowing from it, and from about the firs of August the flow had been substantially rising except the la twenty days of October. I found my next estimate at 5,510. A shown by the hydrograph, that point was passed right after Novem ber 1, 1912 and about fourteen second feet of water was flowing The next place I found was 5,570. The tunnel passed there abou November 1, 1912. I found .05 of a second foot. Approximatel 14 second feet was flowing when the tunnel passed. I found my next quantity with reference to the hydrograph at 5,800. That wa passed in the latter part of December, 1912. I found .05 of a sec ond foot. 13.2 second feet was flowing at the time the tunnel wa driven by that point. The next point that I found was at 7,100 The tunnel passed that point near March 1, 1914. The flow I found there was approximately .05 of a second foot. About 10 second feet was flowing at the time the tunnel was driven by that point.

As shown by the hydrograph, from a point in about 5,383 and from about October 1, 1912 to about February 1, 1914, a period of about sixteen months, the flow was decreasing continuously, from 14 second feet down to 6.5 second feet. At 7,320 I found .10 of a second foot. When the tunnel was driven by there 9.7 second feet was flowing from it. The next point where I found water was 7,600. The tunnel passed there about May 7, 1914, and there was then flowing from the tunnel 9.6 second feet. The next point I found was 7,800. They went by there about May 20th, 1914. The hy drograph shows that 9.6 second feet was flowing. I found .10 of a second foot. The next place I found water was 9,325. The date they passed that was about September 20, 1914. The flow from the tunnel was then 10.4 second feet. For a period of practically eight months the lowest flow of water from the tunnel had been 8.6 second feet as shown by the hydrograph. The mean flow during that time had been about 9.6 second feet. They passed a point 9,580 where I found the next estimate flow on October 15, 1914.

I found .10 of a second foot visible. 9 second feet was flowing from the tunnel when they passed that point. At 9,785 I

77 found a flow of approximately .15 second feet. They went up there about March 1, 1914, and the flow was 8.8 cubic

feet per second. That is the last point except the flow coming immediately from the face and measurements of which I have given.

The hydrograph shows that the high peak of the flow as they went towards the face was struck February 1, 1915, and the flow at that time as shown by the hydrograph was 17.11 second feet and the two measurements that I made this year (1918) show 13 and a fraction second feet.

In going through the tunnel I made notations of some of the openings in the rock. The visible openings in the rock were numerous; large and small, I guess there were hundreds of them. Quite a number were large openings greater than an inch. Some of the openings in the rock that were dry at the time I was through there I noticed were worn smooth and in some there were deposits of sand indicating to my mind that some time previous and probably for a long period they had been conveying water.

Cross-examination:

I never studied geology at school. My experience has been as an irrigation engineer. At the time we were in the tunnel in February, 1914, I was an employee of the defendant, Midway Irrigation Company, in this case.

The first measurement I ever made up in the country that is now in dispute was in 1914.

The float measurement is not considered to be as accurate as a weir or current meter measurement, for which reason whenever I can use a current meter or a weir I do so.

I went into the tunnel at the request of the defendant company with the purpose of making a detailed examination to qualify myself to testify in this case. The officers and employees of the plaintiff company gave us measurements and helped us whenever we asked for help.

I have represented on the maps, Exhibit 1 and Exhibit 1-*a*, a portion labeled "Bonanza Flat." That is the head of White Pine Canyon above the township line. It is not as steep as the canyon from the township line down to the mouth of the Snake Creek water shed; it is a flatter country, a large area there being relatively flat up to the lakes shown and then rising abruptly to the main ridge.

78 If you should draw a line from the portal of the Snake Creek tunnel easterly and westerly, thus dividing the area into a north part and south part the area north of that line would be between 13 and 16 square miles.

Referring to my exhibit No. 1 it was not my intention by widening these yellow tinted portions at places and narrowing them in portions to indicate that that was the proportion of the water flowing at these particular parts. Where they are wider, as for example, down in the lower right hand corner of the map, it shows mainly a widening of the canyon at that point, the distance between the base of the slopes. I have represented on Exhibit 1 the reservoir that was placed there by the Midway Company to which Mr. Van Wagonen testified

when he was on the stand, and it is labeled "reservoir." That is the southwest quarter of Section 31, township 2 south, range 4 ea so that in order for Midway Company to get their water out of th reservoir, they would take it from the reservoir through White Pi Creek to a connection with the Snake Creek.

Taking the crest of the ridge running from the center of the e line of Section 25, commencing there, running easterly, the wat goes either to Weber or Salt Lake water-sheds, and that would al be true of the crest running from the east and west crest, souther so that the north or northerly of the Snake Creek district and easte of Snake Creek district, the drainage is either to the Weber or Cotto wood or to the Provo River.

A small part down there in the southern part would go to the Pro River.

These measurements that I gave of small streams coming in various parts of the tunnel, were not measurements—they were on estimates. We clear out the gravel and make a little channel for running to the conduit, make an estimate of it the best I could.

In the tunnel I found openings which in my opinion were op water ways; that were open so water could flow freely through the just as you would find a sluice. They were underground wat courses. I am not able from the examination of my notes to poi out those places in the tunnel. The one I mainly remember was the left side. As I remember it now, it came out into the tunn probably three or four feet above the base and sand deposits from bo
sides. The sand deposits indicated to my mind that befo
79 the tunnel was cut through there, that this particular fissu
contained that sand deposit.

It was about six or eight inches in size from wall to wall. Part the opening was rounded as though because of the flow of water. was dry when we were there. I did not pretend to count the numb of fissures or fractures the tunnel encountered as it progressed. W went into the tunnel in the afternoon about two or three o'clo and came out about nine that night. I went back the next mornin and came out a little before noon.

The Provo River has a high flow and a low flow during ea season. From the average for a period of twelve years, 1905 to 191 the high point is 1,445 second feet. Each day for twelve years compiled and the average taken the same for each day for the s months prior to September. This average that I give of 1,445 secon feet occurs on June 7th. The low point is August 18th and 19th 304 second feet.

The approximate distance from the Mountain Lake tunnel to th Caribou Springs is a mile and a half. From its junction wit Snake Creek to its head Caribou Creek is about a mile and a half i length. The length of Snake Creek from its junction with Lavin Creek to its junction with Caribou Creek is nearly a mile. Th Mountain Lake tunnel is 900 feet lower than the Caribou Springs.

Redirect examination:

I stated that the waters of Snake Creek and Lavina Creek naturally commingle. Since the driving of the tunnel there has been a change. They now run together by means of a pipeline. The first pipeline runs from a short distance below the Snake Creek tunnel taking the waters from Snake Creek and from the tunnel, and what comes from the left hand fork, and carries it over and joins it with Lavina Creek near the mouth of Lavina Creek gulch; then it is again turned into a wood stave pipeline and carried down the left side of the canyon to the point of the Utah Power & Light Company. This pipeline, at this opening near the tunnel, takes all the water flowing from the tunnel and discharges it into the forebay of the main pipeline. So [*such*] of the waters of the tunnel anybody concerned sees fit to use for power are used for power.

At the location of those three culverts across the road there is a slope from them two ways. The road is on a grade going upstream, I would say about four per cent and water would run down
80 the hill in the same direction the road comes from. The road is built along the hillside about 500 feet from the creek and the creek is about 50 feet below the road and the grade to it over the culverts would be ten per cent.

It would take one man a long time to count the openings, large and small that are perceptible in the two miles of the tunnel length; two or three weeks I think. The water came in in streams near the face of the tunnel; visible streams. I could see the water running out of some of them. I could not see the openings because the water [proje*x*ted] out from the face of the rock.

The purpose of making the measurement 417 feet from the face of the tunnel was to know the quantity of water that was flowing from that part of the tunnel. My judgment is that practically all of the quantity of 6.87 second feet was flowing from near the face.

Recross-examination:

From the appearance of the three culverts I judge they were put there for cross drains to carry water from the upper side to the lower side of the road.

The water that was coming from near the face of the tunnel was coming in a stream. I do not know whether there was, or had been, a cave there. They were having some trouble there but I do not remember what it was, nor how far we were from the face.

Redirect examination:

I made a tabulation showing discharge from Snake Creek water shed as observed by me in the year 1914 up to and including May 24, 1918. This tabulation shows the amount in each of the diversions at each time and the total as testified to in my answers to questions put to me.

The tabulation referred to and identified as Exhibit 109.

EDWARD A. TAYLOR, a witness produced by the defendants at th first trial of this cause and whose testimony was read into the recor of this trial, testified in substance as follows:

I have had about fifteen [year-] experience in practical minin I am acquainted with the country lying northeasterly and westerly o Midway, comprising most of the territory of Snake Creek; also o the Park City side and some on the American Fork side
81 Speaking generally, the character of the country north an westerly is very mountainous; something similar to the Snak Creek drainage area.

I resided at Park City for practically five years. During that tim I passed over Snake Creek drainage area several times.

I think actual precipitation at the head of the Snake Creek drain age area would be greater than at Park City. In the early sprin months before the snow has left I have observed a large flow of wate in Pine Creek and in the fall have passed over the same places whe there was no water flowing. I have also observed that at the hea of Pine Creek there is water at all seasons of the year; it is swampy area.

This area is somewhere near the Government subdivision marke "30" on the map. I would estimate the area as being 200 fe northeast and southwest and 300 or 350 feet along the gener course of the stream. That is the Bonanza Flat country. I woul say the area embraced in Bonanza Flat would be about 500 acre I think it could be called a plateau. The bordering mountains ar very steep and in some places precipitous. In the early sprin months when the snow has been going off I have seen streams in a of the gulches indicated here. They are given names as they are o the map. From Caribou, Snake Creek, the Left Fork of Snak Creek and there is also a perpetual running stream along about th middle of 17. It is not delineated upon the map as to the wate course. The slope of those gulches in which the water courses ru is generally quite steep. The greater source of precipitation in tha country is snow. Snow stays on until August in places where it i sheltered and has been drifted heavily; in just the upper part. I the lower portion of the canyon it will go off in April. In Jul there will be considerable snow in the high portions.

I was connected with the work of driving the Snake Creek tunne from March 1910 for a period of three and one-half years. M partner and I had a contract to construct the tunnel. We drove i in something over 5,000 feet.

The tunnel was 10 feet wide, 6 feet above the rail, with a water way on the right hand side going in $3\frac{1}{2}$ feet below the level and feet wide, more or less concave in its general outline. So far as w drove it the tunnel passed through solid rock; solid only in geological sense and the work was done by blasting. No water wa encountered until we were in about 2,800 feet, where w
82 struck a very small stream. When we next struck water w were in about 3,500 feet. From that on we encountered

water at much more frequent intervals and in large amounts. We had water almost continuously after that.

Commencing back at 2,800 feet and describing the flow of water coming in, how it came in, the character of the flow, what means it had of getting into the tunnel and whether the flow was permanent or ceased or partially ceased as we drove in, will say that the first water we encountered was in small amounts and occurred in some slight fracture where there was a down fold of the bedding planes of the rock. We encountered more after passing through a porphyry dike.

The next we encountered was in quite large volume occurring in a fissure crossing the tunnel at approximately right angles and nearly vertically. It was a fissure or fracture through the solid limestone. When we first struck it it was 6 or 8 inches wide and water was coming out of the sides of the opening later in the wash, and in blasting and getting the loose material from it, it widened out considerable. We were obliged to leave the face when we struck that water. Before going to lunch there was no water in evidence. When we came back the men engaged in drilling had penetrated into this fissure and the holes already drilled were flowing full of water and threw out streams from each to their full capacity with sufficient force to strike the roof and the water deflected back to a considerable distance out into the tunnel. We were unable to work at the face and that condition continued about five days when the flow had sufficiently decreased so we were able to get in again. We finally blasted and the walls of the fissure were opened up. This was along about April or May, 1911. The flow of water from this fissure gradually decreased as we went into the tunnel. After considerable distance beyond it the water flowed in mostly from the right hand side, that being the position where the fissure was the most open and it came from above the water level of the ditch into the tunnel.

After we passed the fissure water came in in considerable quantities from the roof and after we had [gotton] in about fifty feet from the fissure the formation became somewhat more open, and we then had large quantities which came in through crushed rock and followed us along as we progressed with the tunnel. We put a cement lining in the tunnel, commencing at a point about 75 feet from the fissure for slightly over 300 feet in length of the tunnel.

It is put in through a bad piece of ground, a formation of
83 black limestone and shale very much decomposed and quite
soft so that means had to be taken to keep it from caving in.

After we had gone by the fissure the water came in from every side, top and bottom, all over, very much heavier than a pouring rain, in some places in streams several inches in diameter. The whole of the rock for a considerable distance was fractured. It was a fractured zone. After we passed the fractured zone there was a very heavy flow coming in from the left hand side through a fracture; it shot out into the tunnel and completely crossed it at first. It was a solid stream of water. The main portion of it being little above the middle of the left hand side, it was almost a sheet of water. The main orifice was perhaps five or six inches wide; lower down it was

from two to three inches. It run with equal force for several mo and then it decreased. We had water at the roof and sides almost continuously for I should say two or three hundred further, when we encountered another very heavy flow. This w be about 4,000 feet into the tunnel. The flow came from the f tured rock. The size of the fracturing would vary from almo knife blade up to one, two or three inches during this two hun feet.

These fractures cut the tunnel at approximately right angles dipped mostly towards the face of the tunnel. The heavy flo about 4,000 feet came through a fissure in very much crushed and the main flow came from near the floor of the tunnel on right hand side. The fissure was filled on account of crushed roc would say the space that was filled was about two feet. The was very strong but diminished somewhat as we progressed.

As to whether or not the tunnel became dry near the porta we went in I can perhaps make more clear by giving a general scription of the water when we first encountered it in heavy f for some considerable distance. Striking the first flow of w which I have said was about 75 feet in from the concrete wh caused a cessation of operations until we got a few feet furthe gained water all the time until we got somewhere about 100 past the fissure, when the country became more crushed and op Then we began to have large quantities of water that came in at near the face. This water followed us along as we progressed the tunnel and gradually dried up back to 50 feet from the fa In other words there was almost a continuous flow for about 50 back to the face which continued down as long as we drove tunnel until we gained on it. Well then we encountere
84 place that was comparatively solid and that flow left There was a gradual diminution in the flow from the fiss during this period.

At 4,000 feet the country was still crushed and we had water co tinuously, sometimes a great deal, and sometimes in smaller quan ties, at openings in the formation until we got perhaps 200 f further along when we encountered still another heavy flow of wat which was in its general nature somewhat similar to the one alrea described. Then going still further we encountered the porphy dike, all of that being wet. The facts as regards to the openin through which the water came are substantially the same as t description given of the other, that is, was in a heavily crush portion in which the tunnel was driven and the water came where crushing was greatest, carrying large quantities of fine sa with it. I would say that the size of this crushed area was abo two and one-half feet. The heavy flow came from about the ar I have spoken of without having any one particular large openin We then encountered a very heavy flow in the vicinity of the co tact with the porphyry dike already spoken of. The condition the rock was very much broken and finely crushed, especial through the vicinity of the fissure. It was very much crushed fro the water course already spoken of to the one under consideration.

The width of this particular character of formation, lengthwise the tunnel, was 15 to 20 feet; may be further. There was a fissure the other side of the tunnel that seemed to be a faulted fissure. was very nearly at right angles to the tunnel and nearly vertical. hat fissure washed out perhaps 100 or 200 mine cars of crushed aterial which left a large open fissure, varying as I estimated from o to four feet in width. There was no precise measurement taken account of the heavy flow of the water. That continued during e entire time I was in the tunnel.

Going beyond that point we came to where the formation that d been faulted evidently by this fissure which occurred at the rphyry dike, and passing that we came into a metamorphosed hite limestone; this was more or less open and carried water in conlerable quantities. This comparatively quite hard [marbl-ized] hite limestone extending possibly more than 150 feet before it sappeared in the blue limestone in the bottom of the tunnel. fter we were through that 150 feet the formation became more ushed again, finer. The water kept with it in considerable nounts in that formation as well. There were heavy flows in one particular place on the left hand side, I should say 200 feet from the fissure already spoken of, taking it to about 4,500 feet, approximately into the tunnel.

From 4,300 to 4,500 there was then a black lime formation which s crushed, but not so fine as previously. It also carried considerle amounts of water through the interstices of the crushed rock. short distance from that again, perhaps 100 feet or more, we uck a considerable amount of water coming in white limestone hich was not so much crushed. That would be 4,700 or 4,800 et in the tunnel and that continued to the point where we quit, mething over the 5,000 foot point.

I would say that the flows of water from the openings decreased om 25 to 50 per cent from the time we struck them until I quit. he total flow at the mouth of the tunnel was very nearly constant r a considerable length of time, up until the time when the last ater was encountered after I had put the work in charge of our perintendent, and which I did not observe personally. In places e drip coming through the roof had dried almost completely; in hers it continued in almost the same manner as when we went rough.

Cross-examination:

I did not drive the tunnel as far as my contract called for. There e some unsettled matters between myself and the Snake Creek unnel Company. I have been made a party to an action in which e Snake Creek Tunnel Company was also a party. My relations ith the officers of the company have been somewhat strained. I ntemplate suing the Tunnel Company.

I would say that I was personally present when each of the flows water I have described were encountered.

As I extended the tunnel into the mountain I did not make any

accurate measurements of the length and width of each fissure, r observations were with my eyes. I did not take the dip or stri of anything in the tunnel with instruments that I have notes of.

I stated that as the tunnel progressed we would penetrate into wet place and at times water would gush out, at times under gre pressure. At the time of encountering these fissures the air wou be bad in the tunnel so that it would be necessary to maintain ventilating apparatus in almost constant operation. I d

86 not take that as resulting from any flow of gas. I belie

that it was due very largely to the absorbing of oxygen fro the air by the water, leaving the resulting constituent of the air nitrogen and carbonic acid. I do not think there was an appre able odor but the air became impure.

As we advanced the tunnel, it was noticeable that in some plac the water would diminish its flow from behind further out in t tunnel and equally imperceptible in others. In pene-rating in the fissures in which there was considerable water, it would flow o very rapidly for a while and then gradually diminish until reached a very light flow, in some cases as though it were a litt reservoir that had been tapped or any other condition that mig prevail.

In one particular instance I noticed a necessary relation betwe the diminution in the flow of a stream that had already been foun and the increase in flow of one that had just been encountered. was after encountering the first heavy flow of the fissure just insi of the concrete. There as we were driving, we apparently pick up the water that was flowing through the fissure in considerab force as we progressed through the tunnel. The water followed along for about 50 feet for a distance of 200 or 300 feet and as w picked up this water the water decreased in the fissure.

There were two porphyry dikes intersected that were plainly o servable. I estimate that the first was 2,600 or 2,700 feet from th portal. Its width was about 20 feet, its strike was across the tunn at not quite right angles. In character, it was generally hard.

I estimate that it was 1,700 feet from that to the next porphyr dike. It was somewhat hard to determine the width of that dik one wall not being well defined. Judging from the wall on the fa end the strike of this dike was approximately at right angles to th tunnel.

We [encounteres] one other small porphyry dike between th two already mentioned. In width it would average about one an one-half feet. It was near the fault contact and showed up a around the walls and bed of the tunnel. Passing through the fir dike we encountered the por*y*hyry filling which we followed for distance of about 100 feet to 150 feet.

Redirect examination:

I spoke about the first porphyry dike that we struck beyon the concrete and a porphyry sill. The sill was a sheet o

87 porphyry evidently coming from the dike and was from tw to two and one-half feet in thickness; it was virtually a por

ion of the porphyry dike, the same nature of material, and could be traced within a few feet of its intersection with the dike. This dike, the first we encountered, was about 300 feet towards the portal of the tunnel from the beginning of the concrete; about 2,600 or 2,800 feet from the portal.

You understand me to say that in most instances the water would diminish behind us as we prosecuted the work on the tunnel, in some places more rapidly than others. I noticed that as long as the face of the tunnel remained in one place, by reason of delayed work, for any length of time, that I did not notice any diminution in the flow while the face remained there, that is in some of the flows.

The first porphyry dike encountered was about twenty feet thick. The next dike was just at the end of the concrete that was put in. The other was about 4,000 feet from the portal of the tunnel and I would judge 50 feet thick. That is all the porphyry encountered so far as I could determinee.

Sterling B. Talmage, a witness produced by the defendants, at the former trial and whose testimony was read into the record of the present trial, testified in substance, as follows: I was with the party that went into the Snake Creek tunnel on the 22nd and 23rd days of February, (1915). We went from the portal as far as we could; up to the water. I made observations as I went in and took notes. The predominating rock through which the tunnel passed was, for the most part, limestone of different characteristics. The tunnel, in passing in, passes from one bed to another, the beds dipping somewhat in the geneeral direction the tunnel run, consequently the tunnel at different points cut different beds of limestone; some gray, some of a dark color; some metamorphosed, almost white; but practically the entire sedimentary rock exposed in the tunnel is limestone.

The dip of the strata is not uniform. Through the major part of the tunnel the dip is towards the face or in the direction in which the tunnel is run. There are local folds at places where the dip is in the opposite direction. This limestone is fissured and fractured in many places. I did not form an estimate of the number. I recorded a large number of the prominent features noted in passing [ghrough], but not all.

The fractures and fissures in the limestone seem to be of three general sets. One set of fissures strikes almost at right
88 angles to the tunnel and there is a general parallelism between the fissures of that set. Another set strikes across the tunnel at an angle in almost an easterly direction, and there is a general parallelism between the fissures of that set. The third set strikes at almost right angles to the second set that I have just described, that is, in a general northerly direction and there is a general parallelism as to the fissures of that set.

The general dip of most of the fissures in the tunnel is steep, in some cases very nearly vertical. When varying from the vertical the dip is towards the south of the tunnel. There are, however, some dipping towards the face of the tunnel, and some much flatter

but they are generally steep, some dipping in one direction and some in another.

I have put the strike of the places I did observe and noted on the duplicate blue-print of Exhibit 1, which is uncolored. On a small sheet it is not possible to get them on with any exactness as to the distance from the mouth of the tunnel. Moreover, our observations were not made with exactness in the sense that we made exact meeasurements. Mr. McKay was with the party and our notes were checked up every 1,000 feet from a metal block that was set in the eeasterly side of the tunnel, and the data given was checked up and calculated in some instances from counting the ties, and in other instances from certain facts Mr. McKay had recorded.

Defendants' proposed Exhibit V is a duplicate blue print of Exhibit 1 on which I have indicated the strike of the fissures and fractures referred to. The marks in red are running in the direction of the strike and opposite each of these lines I have placed in red, a figure indicating the approximate distance from the portal at which that fissure was observed. In one or two places the lines are close together and the figures run in one case from 5,600 to 6,000 and in the other from 7,875 to 8,000. In those places we found numerous fissures showing a parallelism. The lines within the brackets do not indicate accurately each one fissure but indicate a group of fissures found in that area. The other lines indicate the particular fissure as indicated by the number. At a point 10,193 feet from the portal we came to a change in the formation from lime to igneous rock, from which there has been considerable water. There was a large number of fractures apparently belonging to two systems running across the tunnel at an angle approximately as indicated by the net work of lines. This igneous rock was what we call solid rock but it was considerably fractured. There
89 could not be said to be any regularity in the size of the fissures and fractures. They range from a slight crack to a foot or two in width and some few considerably wider than that. Some were dry; water coming in from others, and many that were dry showed indications that water had previously issued from them for a considerable time.

We found that while water was still running and coming in from the left hand side of the tunnel, the fissure on the east side was dry, and at other points water was flowing from both the east and west side and some water was issuing also from the fissure from the roof or back of the tunnel. There was no regularity as to how the water was issuing, whether it would be on the east or west side and filling the crack or fissure to the entire height of the tunnel, or only partially, or only to the level of the water crest. However, while in the tunnel I saw certain eddies in the water course which I think would be due to some of these fissures flowing near the bottom of the tunnel.

At and near the face there was considerable water coming in, apparently under considerable pressure. I do not know just how near I got to the face, although I went beyond the first line of timbers. I would estimate that at least four or five second feet was

coming in within a short distance of the face. There was an extraordinary noise of roaring and rushing water.

The bright white line on defendants' proposed Exhibit 8 represents the line of the Snake Creek tunnel. I put the red lines on. They represent the dip of the fissures which I have already referred to as they appeared in going in. They are intended to represent the dip of the same fissures, the strike of which is illustrated on proposed exhibit 7.

Defendants' proposed Exhibits 9, 10 and 11 are photographs which I took. Exhibit 9 shows the general topographical features and the lower portion of Snake Creek. The mountains do not show very plainly on account of the mist. Exhibit 10 was taken directly behind the orehouse of the Snake Creek Tunnel Company looking along the line of the tunnel. Exhibit 11 was taken from the end of the dump of Snake Creek tunnel, facing more westerly than the line of the tunnel.

Defendants' Exhibits Nos. 7, 8, 9, 10 and 11 received in evidence.

Exhibit 4 is a topographical map made by the United
90 States Geological Survey and known as the Park City Special.
It represents approximately the northern half of the ground represented on Exhibit 1, taking in the territory which would be north of the line drawn east and west about one-half mile south of Clayton Peak.

The red lines that are indicated upon exhibit 7 along the course of the tunnel are not and do not pretend to show anything else except the angle of dip at which the fissures cross the tunnel at those respective points, and there is no significance to be attached to the differences in the length of the lines. Some are made longer in order to make it more convenient to place the figure opposite the line.

And, moreover, this series of red lines included within the brackets is not intended to represent accurately individual fissures, but to show the fact that it was a fissured zone.

I consumed five or six hours in making these observations in the tunnel.

James E. Talmage, a witness produced by the defendants at the former trial and whose testimony was read into the record of this trial, testified in substance as follows:

There are three physical states pertaining to water; the liquid, solid and gaseous. The solid is represented by frozen water; the liquid by water in its ordinary state and it is converted into the gaseous by heat and by evaporation. The rains and snows are derived from water in a gaseous state precipitating either as rain or snow according to the temperature.

Generally the most commonly recognized condensers of atmospheric moisture are the hills and mountains. Atmospheric moisture rises from the surface of the earth, more particularly from the surface of water bodies. It is mostly impossible to determine

that any particular precipitation is derived from any particular area of any limited extent. The water that falls upon the surface of the earth disappears from the surface proper in three principal ways. Part is taken into the air again by evaporation; part is absorbed by growing plants and is returned to the air through the plants and another part sinks into the soil and through the soil to the rocks beneath and makes its way down to the depth, dependent upon conditions, and there is another part that gathers upon the surface into the surface streams. Comparatively the greater part of the water that falls upon the surface sinks beneath the soil or regolith into the disintegrated rock below, rock that has not been disintegrated into soil.

91 The amount of water which is held in the soil is very small compared with that which is held in the rocks beneath. The holding, retaining or carrying capacity of the rock depends upon its permeability, not in the sense of a uniform state of porosity, but with reference to breaks or cracks, joint planes, which are characteristic of all rock matter and along which water does pass in the solid rock mass, constituting the upper part of the solid floor.

A solid, impervious rock mass would permit no water to pass through it. If such rock mass be broken by joint planes, cracks, or fissures, it would present the best possible condition for carrying and permitting water to pass, and the rock at depth consists of purely solidified particles which would be represented in its nature as sand and would hold much water but would not permit it to pass or flow rapidly.

The ultimate source of supply of mountain streams is precipitated water, and that mostly of snow. The proximate or immediate cource of any particular stream may be and usually is a spring or series of springs through which the water is returned after having been taken into the rock mass or soil.

In the Snake Creek country there is a period of the year when the snow goes off entirely. Snake Creek and Lavina Creek are perennial streams, flowing all the year. The water which supplies this flow throughout the months when there is no surface flow is collected within the body of rock mass in that region.

The term "intermittent stream" is applied to streams which flow during part of the season to a greater extent than any other part of the year. Intermittent streams exist from two causes. There are intermittent streams which depend almost entirely upon the immediate precipitation and would be manifested as a surface flow after any heavy storm, or during the spring while the winter snows are melting, and on into the summer. The stream flows as long as there is an immediate supply. Another class of intermittent stream would depend on the intermittent character of the springs that feed them, due in most cases to the change in the ground level of the water, and what is known as the water table; that is the depth beneath the surface at which we come to water. The water table or the ground water level rises and sinks gradually so that at any one season of the year we may have the water table so high as to give

forth an abundant supply of water to the spring, and later in
92 the year the water table may have sunk from exhaustion of the upper part of the supply, and the spring then not being fed would cease to flow.

Where there is a gully through which water flows and then ceases to flow and lower down comes to the surface and flows again, technically that would not be classed as an intermittent stream, but as an interrupted stream. Where there is a flowing stream through portions of the water worn depression and this water sinks, it sinks directly into the underlying formation and will descend by gravity along courses, channels or planes of least resistance until it makes its appearance again upon the surface by means of open channels or passages.

In this mountain country streams have an underground flow. In refilled canyons you will have water flowing beneath the regolith formation, a term that is made to include all alluvial loose material on the top and upon the surface of solid rock beneath. Even our big canyons are in one sense partially refilled canyons. A refilled canyon is one that has been cut down in the solid rock and then through fluctuations in the surface flow received deposits of alluvial matter, so that as a fact the floor of rock in these canyons is covered by material known as debris, partially filling the canyon.

Where a canyon is so refilled it is the general habit of the streams to flow beneath the surface through that refilled material and there must be sufficient water flowing there to fill the int*re*stices in the refilling, in order to supply the surface stream.

If a stream flows a certain distance down the canyon and its flow becomes gradually less and it disappears and the floor is not bare rock originally exposed, the natural conclusion is that the water has been taken up by the loose material, the detritus itself, and still flows down the canyon beneath.

Where streams rise from springs they ordinarily increase in size and volume in their downward flow. There is no rule or relation as to such increase, but it is a fact based upon observation that besides the water that is flowing from visible sources, there is water coming in all the time by reason of the reappearance of water on the surface that had sunk into the rock mass beneath.

I have been in Snake Creek canyon many times. I gave some special attention to it in 1910 and 1911. At these times there
93 were no springs appearing naturally upon the surface forming the head waters of Snake Creek. Prior to the times mentioned I had visited the canyons and knew that at one time there were springs at the head of Snake Creek. In 1911 the springs were dry and the waters that formed the head of Snake Creek came from the mouth of the Mountain Lake tunnel. At this time I passed down the creek viewing the canyon walls and observing the surface flow into the creek. There were surface flows into Snake Creek between the Mountain Lake tunnel and the junction of Lavina Creek, and waters within that area reached the creek by other means than surface tributaries.

In 1911 there was water coming from the Snake Creek tunnel.

The waters that came into Snake Creek from its source to Lavina Creek from surface flows was small, less than a second foot.

I noticed on the west side of the creek where water would issue through the joint cracks and fissures in the rocks, which in places rise as great cliffs and enter the creek bed that formed the surface excavation of the channel. Such places are not always visible but you would expect to find them underneath the surface water, coming down canyon streams where the grade is heavy, you would expect to find openings in the formation communicating with the surface creek bed.

The flow of Snake Creek where it joined Lavina Creek the day I followed the creek from the Mountain Lake tunnel was greater where it joined Lavina Creek than at the tunnel. The increase was greater than what could possibly be supplied by the observed tributaries and all the water coming in cracks and crevises in the rock.

In every such limited area as the Snake Creek drainage area there would be one main channel which is the true conduit of the waters of that area and found in the deepest part of that area. There are both surface and sub-surface drainage areas. In a general way the sub-surface drainage area would correspond with said surface area and there are conditions which would make some differences.

I was in the Mountain Lake tunnel in 1911. It is driven into the mountain approximately a mile. I was in the Snake Creek tunnel on the 22nd of last month (February) with others. It was a clean, well constructed and kept tunnel, dry in the front part, wet in the face or end and for some distance back in places. The walls
94 are in plain view; no difficulty at all in observing; it constitutes a very beautiful section of the rock structure through which it passes. The physical features are readily discernible throughout its length up to within fifty or sixty feet of the face. I made observations as we went through the tunnel and note of those observations but made no measurements. Through the courtesy of Mr. Taylor and Mr. McKay we had the survey points indicated to us. They gave us the approximate distance from the portal whenever we asked and we would check up our distance at every one thousand feet by finding the plug that had been set in the wall to mark the 1,000 feet distances. Going through the tunnel I observed nothing that appealed to me as of interest until we reached a point approximately 735 feet in from the portal, where I found a well defined dry water course, which was striking twenty degrees west of north standing nearly vertical. The fissure was well defined across the tunnel, and small debris, such as water brings in and carried along could be observed. It was not a wide course, however, but one that appeared to me to be distinct. I noted none other than the ordinary joint cracks and planes until I reached a point about 1,720 feet from the portal where I saw a slip plane; a plane upon which there had been a movement of the rock mass. That has a strike of about north sixty degrees east, and a dip of about forty degrees northwest.

At 1,745 feet I encountered the first timber work extending about 11 feet. There being timbering for but a short distance would indicate a zone of that width that was loose, and by inference through

which water had come. Then there was a space of about 17 feet untimbered and then the timber was resumed. At 2,440 feet from the portal the beds or bedding planes appeared so well defined that I took their strike and dip. They were striking north 17 degrees west and dipping from five to ten degrees westerly, lying very flat, dipping towards the tunnel face.

Regarding the tunnel as being level, of course for that short distance it can be so regarded, then the beds were dipping only five or ten degrees from a horizontal, a dip in the direction of the tunnel, so that as the tunnel progressed it would be passing through higher and higher beds, since the beds were dipping into the tunnel towards its end, towards the end or face, and not towards its mouth or portal.

At a point about 2,665 feet in, the ground is loose and timbered. At a point about 2,770 feet in, a concrete lining begins which runs to about 3,014 feet. The prophyry dike and sill spoken of
95 by Mr. Taylor would come within that limit according to his testimony. I did not see them. They were covered with the concrete. Within a short distance from there I observed several places, several cracks and fissures, that appeared to be painted red by iron oxide which had been left there by water when it flowed in through those cracks and fissures. They are now dry. This would indicate a flow for considerable time, for that deposition is a slow process. At a point approximately 3,700 feet in, the walls are very deeply covered with iron oxide. At this place the bedding is broken by golds and water is still trickling in near the bottom of the west side. The evidence that I saw there leads me to believe that water had flowed and had ceased to flow. Passing from a few feet beyond the end of the concrete on to the point 3,700 there are a number of small cracks and fissures with the iron oxide deposit, inferring prior flows of water.

In going through the tunnel I indicated only a few of the most important points, my purpose being to observe generally the structure of the tunnel and not to obtain information from which to make a detailed report.

At a point about 3,850 feet from the portal a trickling stream of water was coming from the roof and iron oxide appears upon both sides in large patches. At 3,923 feet, water was coming in from both roof and sides. At a point approximately 4,066 feet from the portal there is a stream entering through a small fissure or crack. At about 4,100 feet there is a stream of considerable size coming in in such well defined form as to warrant an estimate of its amount. At that place the beds are dipping about 30 degrees southeasterly towards the mouth of the tunnel, indicating a fold. At a point about 4,225 feet in, the beds are broken as an instance of folding or crumbling.

A bed, as I am using the term, is a stratum of rock consisting of essentially the same material throughout. We may have one layer or stratum of limestone, then there may have been laid down on that quantities of sand and then perhaps another layer of limestone and another layer of sand. In due time the sand would be converted into sandstone by pressure and there we would have horizontal

layers of limestone and s*t*andstone *and sandstone.* These beds laid down in that original horizontal form are subject to disturbance in the process of the mountain uplift. Sometimes in this mountain region these rocks are carried up with small or no disturbance. In usual mountain regions they are seldom carried in that way, being carried up tilted and then have a dip from the horizontal.
96 In some parts of the Wasatch range we find quite closely
folded beds. In the process of folding the sedimentary beds are broken. In a particular place under consideration in this tunnel, the folds in the beds are gentle but nevertheless they have broken in the folding as they are very [britt*al.*]

The last point I described was such a region of beds broken by folding or crushing. The line of separation between any one of these beds would be the bed plane and you would see such exposed as you go through the tunnel. Where we have a series of stratified rocks of this kind where the rock is entirely regular, we find joints or joint planes. Without any folding or disturbing movement of any great extent you will find one set of planes which will be practically parallel with the bedding planes and another set will be at right angles. Viewing that sedimentary rock as you will, we find it crossed and recrossed by joints and joint planes and among them we can generally recognize the two prominent sets of joint planes which are called master joints. Such you will find in an *indus*turbed series of rocks, the joint being due possibly to contraction in cooling off if they have once been heated or in drying if they were once wet, but wherever the folding by the uplifting process occurs there will be invariably slips and faults along the line of the fold in the course of the folding.

In the course of the tunnel I found a great number of open fissures, which in some cases are due to slight faulting and the subsequent flow of water to enlarge the openings, and sometimes due to joint planes, which perhaps have been enlarged in the same way by the flow of water, a fissure properly speaking.

At a point approximately 4,515 feet into the tunnel there is a well defined fissure crossing with a strike north 85 degrees west and a dip of 76 degrees northeasterly. Water is there entering on the hanging wall of this fissure, and collecting in the bottom of the tunnel in considerable quantities. I estimated it to be about .50 of a second foot. At 4,595 feet there is a fissure crossing the tunnel. You can see it on both sides and in the roof. I noted it particularly because it has been widened by running water. In the upper part of the westerly side it is large enough for a man to crawl into and measure it. At a distance of 4,595 feet there is a deposit of iron oxide indicating perhaps a long continued flow. At a point 4,680 feet in from the portal there is an open fissure or fracture plane practically at right angles to the tunnel with a dip of about 80 degrees
97 in the direction of the tunnel. The water is entering there
through a fissure with walls nearly three feet apart.

At the contact of the limestone with the igneous rock, it is called by miners, porphyry, the walls of the fissure are somewhat water worn, indicating that greater quantities of water have flowed than

now flow through it. The contact of the lime and porphyry is visible, but the porphyry section beyond is timbered and that is quite in line with the usual procedure; porphyry being generally readily slacked down by the water is unsafe to work in unprotected.

Very close to 5,000 feet in from the portal the section shows faulting or bending and clayey limestone comes in. That section is timbered again because of the danger that naturally results from these faulted beds. The beds have been somewhat displaced and would strike almost due north and their dip is about 16 degrees steeper than usutal. At a point 5,080 feet in water is coming into the tunnel through the lagging on the west. I estimated a twentieth of a second foot is coming in. 'About twelve feet beyond that there is a little fault extending across the tunnel, visible on both sides and in the roof, it is nearly vertical. There is a trickling stream of water coming into the tunnel through that fault and a deposit of iron oxide. The strike is in the direction of the face of the tunnel and the dip at right angles to the strike.

A little beyond, 5,135, there is a nearly vertical fissure at right angles to the tunnel. At 5,150 feet there is water coming in through a fractured area, so profound as to cause the rock on the east side of the tunnel to break down. Water is coming in at that place in]tric-ling[streams. At a point about 5,200 feet there is a well defined contact of almost black with light gray limestone. At a point 5,390 feet there is a large open fissure striking north 45 east with a dip of 50 degrees towards the mouth of the tunnel. Water is still coming into the tunnel through it. At 5,470 feet we came to a fractured zone, out of which water is entering the tunnel and the loose material has broken away so that by putting our lamps up through the roof timbers we could see that it had broken away to the heighth of as much as 30 feet. In other words, that fissured zone running right across the tunnel had broken away the material and then it had fallen down to the height of approximately thirty feet. At 5,510 was an open water course delivering about .10 of a second foot of water, striking north 20 degrees east and dipping outward, toward
the mouth of the tunnel. At 5,040 there is an open dry fis-
98 sure measuring two feet or more between the walls and an
abundance of loose material which the miners commonly call lime sand lying on the bottom and you could shovel it up. This indicates that the prior heavier flow of water which carried that debris had left it there and that the present stream is not sufficient to carry it away. At 5,540 is another fissure crossing north about 37 degrees east with practically a vertical dip. At 5,570 another practically parallel and water is there coming in and is delivered into the tunnel by a two-inch iron pipe that has been inserted into the fissure. Between points 5,780 and 5,820 there are a great number of these fissures; I did not count them. I simply noted numerous fissures and fractures, some trickling; others running a good stream and others dry; all approximately parallel.

At a point, described to me as 6,380 feet, we reached a railroad switch. There we encountered a fissure zone with many small streams coming in between the walls of the several fissures, mostly

steep, running from the vertical to 80 degrees towards the mouth of the tunnel. At 6,440 there is a large open water course running at right angles to the tunnel, visible on both sides and in the back and 12 to 18 inches between its walls. It is dry about, but water is entering at the bottom on both sides and there is loose material, indicating a former greater flow. At 6,500 is a water course dipping about 80 degrees towards the mouth. At this point the tunnel is practically dry for 100 feet, being very slightly fissured or fractured throughout that space. At 6,750 there is a water course about two inches wide with a dip of between 70 and 80 degrees towards the mouth, cutting squarely across the tunnel, practically dry. At 6,770 there is a parallel fissure and thence the tunnel is dry.

Between 6,770 and 6,850 we encountered an open fissure striking north 19 degrees east and dipping 75 degrees towards the mouth of the tunnel, practically dry. Six feet beyond that is another almost as well defined and parallel to it. At 6,850 there is another parallel water course dipping 85 degrees towards the end of the tunnel, a normal [*d*issure] again and the breaking away of loose material, estimated to the extent of 25 feet about the roof of the tunnel. At 6,865 there is another; at 6,875 another and anotner at 6,920, all parallel to the one last described. At 6,980 there is an open water course 18 inches between the walls, dipping between 80 and 85 degrees to wards the mouth of the tunnel.

At 7,050 feet there is an open water course from one to two inches between the walls, delivering water in a well defined
99 stream. At 7,060 there is another parallel to the last with an abundant deposit of iron oxide. At 7,080 there is a fissure approximately at right angles to the tunnel, dipping 80 degrees towards the mouth measuring in places from one to two feet between the walls. At 7,100 there is another parallel to the last; water coming in on either side. At 7,130 there is a well defined fissure which has a strike north 48 degrees east and which dips from 60 to 70 degrees in the direction of the tunnel. At 7,170 we encountered timbers and the place between the last fissure and this point is dry. Here we encountered badly broken rock and the fissures were dry. At 7,220 there was a small dry fissure with iron stain on both sides of the tunnel striking north 80 degrees east and dipping about 80 degrees towards the mouth of the tunnel. At 7,320 the tunnel is timbered and waters come in on both sides between the timbers. At 7,470 there are two sets of timbers, indicating loose ground and some water coming in on the west side.

At 7,520 there is a large open water course dipping towards the mouth of the tunnel, now dry, but the loose material, lime, sand and debris tells of a former large flow. At 7,550 there is another open water course with evidence of former flow, water worn debris still lying in the fissure. At 7,575 there is a fissure with an opening of approximately two inches between the walls, somewhat water worn, dipping towards the mouth of the tunnel about 80 degrees. At 7,600 there is a parallel fissure to the last as to strike but slightly flatter. Water is entering there. At 7,660 there is a prominent fissure six inches between the walls, dipping about 60

degrees to the mouth of the tunnel. At 7,725 feet there is another parallel to the last.

From 7,750 to 7,790 there are many small fractures with water entering along the plane of fracture. Then follows one set of timbers in a more highly fractured region. At about 7,800 feet there is a two inch iron pipe that has been thrust into an open fissure and from that pipe a stream of water is delivered, with water escaping, however, around the pipe. Its course is north 15 degrees east and dip about 85 degrees towards the mouth of the tunnel. From 7,875 to 8,000 I counted nine fissures from each of which water was running into the tunnel. From 8,040 to 8,060 there are three well defined flowing fissures with iron stains on the wall, coursing north 70 degrees west and standing almost vertical. At 8,150 there is an open fissure, with water coming in on the west three inches between the walls. It dips towards the mouth of the tunnel.

100 At 8,134 there is an open space in a fractue plane in the foot wall; evidently a little slip there. That course is north 65 degrees east and dips towards the mouth of the tunnel. At 8,170 there is a dry open space with lime and sand in a now empty fissure, about four inches in places between the walls. At 8,215 and for 10 feet on, the water enters from both sides in small streamlets. From 8,225 timber extends for approximately 35 feet; water coming in from the sides and top. At 8,270 there is a well defined open fissure coursing 70 degrees east and a dip of 85 degrees towards the mouth of the tunnel. Thence on to 8,370 we passed eight parallel [fissure-], all delivering water.

At 8,400 feet there is an open fissure delivering water at the base and on both sides; crossing the tunnel at right angles with a dip of 85 degrees towards the mouth of the tunnel. At 8,460 there is a parallel fissure and another five feet beyond. At 8,915 timber begins and extends practically to 9,000 feet and the ground is bad. No water is coming in there. At 9,090 there is a tongue of igneous rock comes in. At 9,115 we are in a solid body of igneous rock which is slacked down in places necessitating timbers which extend for about 80 feet. At 9,325 there is a strong stream coming in on the east near the top and little streams come in at intervals for a distance of 100 feet. At 9,435 there are fissures and vug holes, holes that have been worn in the limestone, irregular in shape, but they are all water worn on their edges and water is still coming out through some of them. At 9,580 water comes in from a fracture which strikes north and is vertical and another parallel to that occurs six feet on, also delivering water.

At 9,795 there is a two inch pipe inserted in the tunnel, and these fissures deliver a good stream of water. I estimated it as being from 60 to 65 gallons per minute. Thence on to nearly 10,100 water is coming in from the sides and roof in streamlets. At 10,192 the limestone is almost like marble and there we find its content with the igneous rock which continues to near the present face. We could not go right up to the present face because of the great rush of water, and water is coming in all through that distance along the fracture planes of the porphyry and while the prophyry is not a

bedded rock like sedimentaries, it is marked by very clearly defined joint planes, and water is flowing in along those joint planes, many of those are water widened.

At present there is a great large flow of water at the face. On the day of my visit men were engaged in working a side drift to go
around the flow of water, or the place where water was
101 escaping. This side drift was strict-y dry and good ground
from a miner's standpoint. The face proper is not timbered, in a miner's sense. It is held up by a system of timbers to support the roof. Several feet back from the face there are very heavy timbers placed within a few inches of each other and cross timbers are also in place, the whole being a strong structure placed in position to hold up the top and sides; but water is escaping at the face, near the west side more particularly under this pressure, with great noise and coming out with great force.

You do observe water coming in near the bottom of the tunnel. Sometimes it comes in with such force as to show itself entering the water in the ditch proper, which is the usual condition in tunnels of that kind.

There are different sets of fissures, probably those of each set produced by one cause and possibly at one time. There are those that dip towards the end of the tunnel; those that dip towards the mouth and those that extend practically vertical. The strike is more uniform than the dip. There is such a grouping or similarity of habit as would cause belief that what is seen in the tunnel was characteristic of that drainage area. There is no doubt but you would expect the formation to extend as to openings and fissures and fractures off to the east and west of the tunnel. What I saw in the Mountain Lake tunnel would confirm the opinion that the general characteristics of fissures and fractures that I saw in the Snake Creek tunnel is characteristic of the whole Snake Creek drainage area. From what I have seen in the tunnels and underground in this region I think we have a natural normal and ordinary uniting of underground drainage; underground water flow.

There is a similarity between a surface water course and a tunnel driven into the mountain. As a stream flows upon the surface and cuts its way deeper and deeper into the rock it opens up the side cracks and fissures by which and through which water can come into that open channel, and as the tunnel is driven into the rock, it opens by cutting through those fissures, cracks and breaks so that the water which is flowing through there finds its way into the tunnel.

The bedding planes undoubtedly carry water for some short distance, but they are not the main veins of flow. The principal veins of flow through the rock are the open cracks or existing breaks observed in the tunnel.

102 If the open fractures or breaks found in the tunnel were
projected upward on the same plane, they would reach the surface. The upper part may be filled in by loose material, but it is often found that such a fissure coming up through the rocks at that depth will break into several minor fissures near the surface.

You would find a lot of tributary fissures going into one. These fissures, faults, fractures and joint planes reach the surface without a doubt. It is not a matter of opinion, I take it, but a demonstration, inasmuch as they receive the water primarily and ultimately from the surface deposits of moisture and their precipitation upon the surface ordinarily, and these fissures, cracks or water carrrying channels, water widened joints, drawing from the joint planes or joint fractures, either reach the surface directly or they connect with secondary minor cracks and breaks which do reach the surface.

The effect of the cutting through of these fractures and water courses into the tunnel and thus by artificial means bringing that water cut through the tunnel will of necessity, diminish very largely along those natural channels in the rock and would have eventually reached the lowest stream course in the drainage area. Therefore, the practical effect is to diminish the supply of water of Snake Creek from the former channels and outlets along its course.

Much of the water that would have found its way laterally along the fissure and fracture planes into the Snake Creek channel above the tunnel now finds the least resistance in making its way directly into this open space; and much which would have passed down below the level of the tunnel and would then have arisen as springs along the course of the channel is now received into the tunnel and does not make its way to lower levels. I can make myself plain by illustration.

If you have a vertical pipe and you fill that pipe with water to maintain a supply, the pipe being open at the bottom, water will flow out very readily. Suppose you close the bottom of the pipe and open the valve connecting with a side pipe or a number of side pipes, the water will make its way into those side pipes and the amount that will be discharged by each will depend upon the carrying capacity of the pipe. Now assume that you have such a pipe the height of this room and that you have the side pipes half way between the ceiling and the floor that are delivering the water. Now you open the bottom of the pipe again and give the water a chance to flow out through the large orifice below and little if
103 any water will escape through the pipes above. Thus by driving a tunnel and connecting these natural pipes through which water has been making its way down and distributing itself laterally, finding its way into the tunnel, you have given the course of least resistance, and the result is water will find its way into such a tunnel which would otherwise have found its outlet through the rock channels and open upon the surface at perhaps a deeper level. It is in recognition of that particular fact, perhaps that drainage tunnels are run. This effect would be greater at greater depth. Just as this tunnel is lower than the Mountain Lake tunnel, if you start another tunnel at a lower level you drain this tunnel, for much of the water now finding its way through the channels into this tunnel would find its way to the greater opening below. Water seeks the line of least resistance.

The fissures and cracks containing water, that is demonstrated, they derive that water from precipitation from the surface, therefore

they must reach the surface, as I stated, necessarily must reach the surface as such individual fissures and cracks, or through connections with other minor fissures and cracks which do reach the surface. Now, there may be a great many small cracks and fissures in the mountain rock reaching the surface and receiving water from the overlying soil; that is, the surface rock receives it from overlying soil, which receives it from the snow; such water finding its way into these minor cracks and fissures, thence going into larger cracks and fissures, demonstrates clearly that there is a passage between the surface and the place where the water issues from those cracks. I have made my answer in that form to avoid appearing to convey the thought that these individual fissures reaching, as I have described, some one inch, some two, and some eighteen inches, some three feet between the walls, extend as such individual fissures right to the surface; that would be an unwarranted and exaggerated conception of it. Now, these fissures which I have noted in the channel may not be traced as individual fissures with that particular strike and dip right up to the surface, but they go up necessarily into the rock some distance and connect with other cracks or fissures perhaps of minor order and size which do reach the surface; for if there was no such connection water could not find its way into them from the surface snow.

Cross-examination:

I made an examination of the Mountain Lake tunnel in October, 1910, and was there again for several days in July, 1911, and again in September, 1911. At the time I made an investigation
104 of the tunnels and of the Snake Creek drainage area I was in the employ of the defendants, qualifying myself to testify.

I estimate the distance between the Mountain Lake tunnel and the Snake Creek tunnel to be about three miles. The Mountain Lake tunnel is considerable higher.

It is a fact that water, assuming that there was no fracture in the limestone strata, will frequently find its way into the bedding planes and follow along the course of those bedding planes.

If water did flow along the bed planes in this upper section of Snake Creek it would be flowing away from Snake Creek.

When I spoke of underground channels observed in the Snake Creek tunnel, I meant fissures entirely, using that term to mean all, in general terms.

Speaking in a general way, in all cases where I say water going into the Snake Creek tunnel it was coming in between the face of the fissures, fractures or joint planes. I would not say it is speculative, as to how far any of these fissures, fractures or orifices extended away from the tunnel. I would say that it is a matter that might be inferential.

My definition of an underground water course or channel is any course or channel beneath the surface of the ground along which a current of water finds its way by flow. That would include all courses where the water flows through the bedding planes of stratification, in a broad way.

Redirect examination:

I said it was not a fact that water flowed along the bed planes, dipping into the Snake Creek tunnel and away from the Snake Creek area. In one conception of the case we have the ordinary condition of water flowing which is observable in all stratified rock under common conditions, and very seldom do we find, and in this case we do not find, water flowing along the bedding planes as its chief channel. A bedding plane is a plane; a joint crack is a crack and water will follow joint cracks in preference to bedding planes and where you find bedding planes dipping with a moderate dip as in this case, into the hills, you will find the water more frequently, and in this case you do find, the water coming towards the surface of the hill along the joint planes, rather than following the bedding planes into the hill.

Witness then drew a diagram and explained, while drawing it, as follows:

Taking the condition which has been suggested in cross-examination by counsel, I will ask that this white line be understood as representing the surface, on one section of the surface of the region appears a hill with lowlands on either side; and I will represent in green the beds dipping as counsel has indicated, presenting their basset edges, and to make the representation simpler will represent them as unfolded and undisturbed. In general I represent over the surface of the basset edges a layer of soil and disintegrated rock which covers the solid rock everywhere, to which the name reggolith has been applied, covering the rock everywhere. Now, this soil is represented in green in and over the deposit of stratified rock, which is crossed by joint planes, of which I indicated yesterday there may be several sets, and of which you will almost invariably find two sets at right angles to each other, representing one of those sets of joint planes at right angles to the bedding planes by these orange marks, which are represented as being distinct for each two sets of joint planes do not continue to run from bed to bed; they are confined generally to one stratum or bed. However, the joint plane is a well defined, actual crack, but there may be no separation at all between one bed and the bed lying upon it.

One may grade into the other. There is no space between them except as appears by erosion, but the joint plane follows the crack and water does follow along those joint plane cracks. Considering the water entering the basset edges in such position as this having percolated downward from the reggolith or loose material above, and then flowing downward along the planes or lines of least resistance to the open spaces which it may find, such water flowed down, for example, along the line which I have indicated as *"a"*. It will come to this joint crack which we will call *"b"*. It follows that and it may then perhaps pass down the bedding planes if they be the direction of the lines of least resistance, and it will come to another joint plane, *"c"*, and it may then pass down the bedding planes again if it finds another better way to go, to the joint plane *"d"*. If the water

be under pressure or if there should be openings it may possibly go the other direction, actually working on the bedding planes in a way that would appear to us to be up-hill, if it be there under pressure, and that be the line of least resistance, and we find such to be often the case. Therefore it may go down through the joint plane,
106 *"e"* or it may go down through the joint plane *"f"*, and it
is not necessary for it to follow along bedding planes but in following these joint planes, and sometimes we find such carrying water directly upward towards the surface. Now, that is rather incomplete without this further illustration which I will make separate, so as not to efface the one already made. It is a demonstrated fact that what we call ground water, or water beneath the surface, roughly corresponds to the topographical inequality. Ground water in one sense is standing in the ground except only as fast as it is drained off, the top of which body of water is known as a water table, but the level of the ground water roughly corresponding to the topographical inequalities, and we might find it through the level section *"a"* as indicated by this rough line. Now, that means if you were to sink a well in that section down below this ground water you would find water, that water would stand in the well at a level with the water table or of the ground water, but that ground water level does not continue on through the hills as indicated by the dotted line, but on the contrary, if we find it roughly corresponding with the surface of the hill, if you sink a well, as has been done experimentally, at point *"e"*, you would reach water, and water would stand in the well at the level of the ground water there shown. Now, the level of the ground water is always deepest below the surface the furtherest below the surface under great elevation, nevertheless, it may be actually higher at that place than in the adjoining low land.

Mr. Nebeker: If the Court please, I really don't see how this lecture is responsive to any question, or that it has any relationship or bearing upon the question involved in this case. I think if counsel would ask questions, and the Doctor would answer them responsively, we can make better progress.

Witness: I wanted to show the connection here, but if you say that it can-ot be done I will desist, but a sentence more would explain it, I think.

The Court: All right.

Witness: This ground water is constantly making its way along planes of least resistance, as already said. It is sinking downward but is under pressure at great depth. The water is sinking from that joint plane and crack into the deep, but being under pressure at depth it tends to come out towards the surface of the hill, and it will be forced laterally and not follow according to gravita-
107 tion only but under the pressure due to gravitation it will pass
laterally towards the edge of the hills, but as it comes nearer the surface of the hill due to its relation to this pressure, and there it is subject to gravitation alone. Therefore we find the water forcing its way outward laterally, as well as descending vertically, and

the proof of which I have observed is the running of a tunnel through such a region we constantly cut water courses through which water enters, which water courses dry up behind as you progress with the tunnel.

The strongest tendency of water is to go to the deep. To this however, there is a physical limitation.

The theoretical conception of water extending through fissures to the deep is entirely a part of any movement it has from the actual flow of water in jointed sedimentary rock such as we find in this region, the water is passing downward and outward from the most of that hill and reaches the surface in the normal way. Some part of it extends below the limits of our observation and reaches the surface at some lower level. Much of the water that sinks into the earth crust does not come to the surface again a lake or the sea.

The fact that in carrying the tunnel forward we cut water courses through which water enters the tunnel in considerable quantity, but which becomes dry when other courses are struck as the tunnel is carried further, indicates that we have there a normal condition of the descent and outward spread of the ground water. The water table is highest under the greatest elevation, therefore the pressure of water is greatest there and its descent is more rapid and its erosive effect in the rocks and cavities greater, and as the water descends it spreads laterally and as it goes up it cuts one of the tributaries of the descending water body; that little stream which perhaps finds its way into the tunnel through the joint cracks is connected with a larger body of water in the hill. As we go a little further we would cut into a tributary of which this former one was a branch, therefore we cut off the supply of the first little stream and that water course dries up. We push on further and cut another one into the hill from which this second flowed and with which it was connected, and as we strike that third water course and the second small one behind us dries up and that, I believe is a normal condition in practically any tunnel of any length that has been driven in this region.

108 Cross-examination:

I do not know of my own knowledge that those streams that were encountered in the tunnel did not drain themselves before the tunnel cut into any water above them. It is possible that some of the minor ones would but I do not believe that was characteristic of this tunnel.

According to the explanation I made of the level of the water table, there will always be a rush of water as soon as you cut through one of these courses, and that will continue until the water which finds its way most easily along the planes and channels leading into that discharge channel are drained of their excess water, of the water above them. They won't dry up until you strike another channel with which they are connected.

CARD 2

Redirect examination:

This great hill through which the tunnel is run is, in the sense in which every mountain is, a reservoir of water supplying water below, but in that hill there are no isolated bodies of water which are impounded by porphyry dikes. I fail to find such theory supported by any evidence on the ground, and could not infer at all that any such exist, but on the contrary believe there is abundant evidence to say that they do not exist.

The flow of water from the tunnel under facts I have testified to would permanently lower the ground water level or water table under the hills. It may not effect the ground water level in the low lands adjoining.

WILLIAM W. WILSON, a witness produced (out of order) by the plaintiff, testified in substance as follows:

I reside in Midway and am Secretary of the Midway Irrigation Company. I brought the minute books, the stock ledger of the company and the stubs of the water tickets of the company for 1917 and turned them over to Mr. MacMillan. We have used the same water tickets as far back as I can remember. These tickets are issued by the water masters and have been issued since the organization of the company. They are printed and paid for and furnished to the water master by the company. I do not know whether the water masters keep them or not. The water master turned this book for 1917 back to me. They are printed and paid for by the company and furnished to the water masters, and are records of the company for the distribution of water.

109 William Ablinap preceded me as Secretary of the company. The only records except the ledger that he turned over to me are those I have handed Mr. MacMillan.

As far as I know, the book shown me is the minute book of the company from July 12, 1888, down to and including 1911. That book was turned over to me by my predecessor.

I do not know where the book is that the classification referred to in the motion found on page 43 of that book—"Moved by John Murri, seconded by William Coleman, that the directors have power to classify the rights of each stockholder, and to enter in a book such classification."

I do not know where the plan is, or whether it was in writing, referred to in the motion found on page 44 of the same book, at a meeting held on March 18, 1899, which was—"Moved by I. Jacob, seconded by Sidney Louis that a plan presented by J. B. Wilson for ascertaining the length of time that each stockholder has acquired the right to the use of water for the last seven years be adopted." I never have seen any of the forms referred to in the motion—"Sidney Lewis moved that J. B. Wilson be authorized to have form for ascertaining the extent of rights and also water tickets printed and to draw on the treasury to pay for the same."

I do not know about the book referred to in the motion recorded

n page 445, made at the meeting held on March 28th, 1889, the ame being—"Moved by Wilford Van Wagenen and seconded by idney Lewis that the returns on the blank certificates be made to he secretary within ten days from date." "Moved by Theo. Robey hat the secretary be furnished a book suitable for recording claims s reported by certificates."

I have never seen the report referred to on page 49 of the inutes of the meeting held April 23, 1889, of the Board of Direcors of the defendant company—"President stated that the main bject of the meeting was to hear report of committee to instruct the ater master. Committee on instruction to water masters made writ-en report," then in brackets ("See report on file").

I have not seen the report referred to in the minutes found on age 60 of the meeting held on June 17, 1889, the same being, President stated that the object of the meeting was to hear report f the committee on ascertaining seven years' rights. Bronson stated hat they had seen all interested parties and that the cut down would amount to very little as some were claiming more than they had before. The Board examined the written report and made some corrections."

I have not seen the report referred to in the minutes of the meetg of the Board of Directors on May 5th, 1891, the minutes being, The President stated that the object of the meeting was to consider e measuring of land. Moved by Wilson that two committees of ree each be appointed to measure land under the direction of the resident who was to furnish them with the districts to be measured.

Referring to the meeting of April 17th, 1895, page 106, I do not now where the instructions are, spoken of in the minutes, "Comittee appointed to draft instructions for water masters reported. he instructions were read, amended and approved.

I do not know where the complete Articles of Incorporation of e company are.

The former secretaries of the company handed over to their sucsors what documents they thought important or necessary I supe. The company has no regular office; the office follows the cretary. There are none of the preceding secretaries in Midway ow, I don't know of any. They have moved away; two of them e dead; the last one has moved away.

The witness was requested by Mr. MacMillan to make search for l the papers and documents of the company above referred to and rticularly for the classification of the water rights which was reorted in writing by the committee and the report regarding surveyg of land that was done for the purpose of establishing rights to e water.

Wilford Van Wagenen recalled for further cross-examination, stified in substance as follows:

I heard Mr. Wilson, the preceding witness testify. I do not know here any of those reports are, I never seen them. I do not know

where any of the other records of the defendant company are at the present time. I have no idea how they could be located.

O. N. Friendly, a witness produced by defendants, testified in substance as follows:

I am General Superintendent of the Judge Mining and Smelting Company and the Daly West Mining Company. I have been
111 connected with the Snake Creek tunnel in a professional capacity. The Snake Creek Tunnel Company knew I was so engaged. I was acting for the Snake Creek Tunnel Company in this work.

The Snake Creek tunnel looks to be located about right on Exhibit 1. The tunnel crosses under Snake Creek at 1,100 feet in from the portal. The tunnel crosses underneath Caribou Gulch at about 6,500 feet from the portal; then it crosses under Caribou Gulch again at about 8,400.

At the time of the other trial the tunnel was driven in something like 10,638 feet. Since that time it has been driven in further. The course of the tunnel is north 25 degrees, 3 minutes, 27 seconds west, and it goes to 12,800 feet upon that course, then it turns to north 30 degrees east. Its distance in on that course is about 1,700 feet. At that point it does not communicate with any other opening. The face of the tunnel is in the natural formation.

Ernest S. Kohler, a witness produced by the defendant at the former trial, and whose testimony was read into the record of this trial, testified in substance as follows:

I have been a farmer for about twenty years. I own land and irrigate it myself and have been farming on that land for fifteen years. My supply of water for irrigation is drawn exclusively from Snake Creek.

I am acquainted with the Mountain Lake tunnel. I worked there in 1900, 1901, 1902 and 1903. I was there when water was struck at what is called the Buehler switch. The water came in in big quantities when they struck it. I was working right at the face. I put in the blast and that released the water. It came in with a big rush and big force. We had to quit working for ten days or two weeks, the flow was such that we could not work. This water flowed down Snake Creek. There was an increase in the flow of the creek for a time and then it went back to its normal flow. I mean that the creek receded to what it was before. I knew of some springs in that vicinity. They went dry. After the heavy rush of water from the tunnel receded the creek was not increased below there above what it was before we struck the water.

I have seen the creek in recent years and saw nothing to indicate a general increase in the size of the creek and I have not noticed any increase of water for my use within the last three or four years above what it was prior to that time.

112 The water was short in 1913. They turned the water from Snake Creek down the river for a short time and cut us short. Our crops suffered. We did not mature all of our crops.

I said I was working with a drilling machine in the Mountain Lake tunnel. This machine was operated by compressed air furnished by an air compressor run by water from the springs at the head of Snake Creek. When we struck this water in the tunnel there was not sufficient water from the springs to run the compressor.

Cross-examination:

I would suspicion that 10 or 15 cubic feet per second of water came out of the tunnel when we first opened up into that portion of the porphyry. I know there was a big flow.

One of the irrigating ditches at Midway, that carries one stream, ordinarily has from three to five second feet used through it.

I was water master during 1905, 1906 and 1907.

The springs that dried up when the water was struck in the Mountain Lake tunnel were located between 500 and 600 feet above the Mountain Lake tunnel and from 1,500 to 2,000 feet away. The springs that supplied the compressor with water ceased to flow during the same shift that the big underground flow was struck in the Mountain Lake tunnel.

Irvin H. Jacob, a witness produced by the defendant, testified in substance as follows:

I am a civil and hydraulic engineer and have been for ten years. I am employed by the Provo Reservoir Company and the Utah Lake Irrigation Company. I am at present, and have been for six years, engaged in the distribution of the waters of the Provo Reservoir Company to irrigators, and am acquainted with the lands upon which I am distributing water. In general, the lands upon which I am distributing water from the Provo Reservoir Company are comparable with the lands under the Midway Irrigation Company canal system.

Our object in distributing the waters of the Provo Reservoir Company is to distribute just enough water to serve a useful purpose and no more. It is a part of my business to see that no more water is distributed to the irrigators than is necessary. The user is limited to the amount which has been demonstrated to be necessary by

113 the water masters acting under my direction.

I took a measurement of the quantity of water I was distributing yesterday and found that we had 190 second feet in our main canal. We were distributing to 9,275 acres. That would be a gross duty of 48.8 acres per second foot.

The crop season at Midway is late as compared with the Salt Lake or Provo valleys. Grain matures a little later; between the first and last of September. I know of some grain last year that did not mature until October. In the Salt Lake valley grain matures from the 15th of August on. Midway is about a month later. This

would require the use of water a month later to mature grain under the same circumstances and conditions.

Taking a large tract of diversified crops, I would say it requires more water in the early part of the season than it does in the latter.

Cross-examination:

Usually in the first part of the season, they are irrigating everything, grain, alfalfa and all the crops and later in the season, after the grain is off and some of the early fruit crops, they are not irrigating as extensively as in the first part. Grain crops require more water the first part than they do after they are matured.

The diversity of crops has quite a bit to do with successful irrigation scattered over a whole tract; for instance, if a whole system was in alfalfa our economic duty of water would probably increase 50 per cent; it would require 50 per cent more to get over it in time to save the alfalfa.

From July 15th we irrigate alfalfa the rest of the season up until October 1st. During ordinary years we are irrigating alfalfa four times during the season. The first irrigation we would have to use 50 per cent more water for the reason that usually the soil is more porous during the first irrigation and absorbs more water.

If the whole acreage was planted to alfalfa, during the irrigation of alfalfa, it would require more water. It might require only two weeks, three weeks or a month to irrigate the alfalfa the first time. I meant to infer from that the value of diversified crops, the necessity for it, for economical application of water. Ordinarily grain would require the most water during the month of June and up to
114 the 15th of July.

Redirect examination:

Usually the soil is saturated early in the spring but it is dried out by the time the first irrigation is applied and at that time it is considerably more porous than it is later in the season. It is a physical, practical, demonstrated fact that the first irrigation of any crop requires more water than the second.

Water put on the soil is to some proportion absorbed by the plant; other portions are dissipated by evaporation from the soil surface, and percolation through the sub-soil.

N. C. Springer, a witness produced by the defendant at the former trial and whose testimony was read into the record of the present trial, testified in substance as follows:

I live at Midway. I have been there all my life. I have been acquainted with the head waters of Snake Creek since 1896. I was mining in the head of Snake Creek in 1896 on my own ground known as the Panama, which joins the Mountain Lake on the east. We have small tunnels both on the north and south of the creek bed. Our first tunnel would be between 1,200 and 1,500 feet down the creek from the Mountain Lake tunnel, and our tunnels are right down on the creek.

The first tunnel we call the Tantamount tunnel. I think we started in April, 1897, on the north side of Snake Creek close to the bed. We dump right into the creek. We have two drifts; one to the right and one to the left, we have 100 feet of work in all.

In driving that tunnel we encountered water dripping from the roof and seeping in at the sides. We noted water there the first year. The other tunnel was driven on the south side in that vicinity and in the same year. We did not encounter any water there.

I have been at the tunnel I have described, on the north side annually, generally in November and December. The water condition I described continued until the fall of 1914. It was then dry, it did not drip any water at all. That was the first time it was ever in that condition to my knowledge. We have two more tunnels; one was started in 1898, driven in at the same time as the Tantamount. We
call this the Comrade tunnel. It run in the same country and
115 in the same formation, consequently we had water just the
same.

As to the extent of the water and how it would effect our work, we would have to work in gum clothes, it was dripping down and wet. We would get wet in working. I believe we had that tunnel in close to 160 feet. The water was always in the face of the tunnel. It would dry up behind us as we drove in. Where we did the work was where we had the most water. This tunnel caved in. We have not been able to get in to it in the last few years. At the time we quit it was a wet tunnel.

About 200 feet below there we started another tunnel and drove it in somewhere between 150 and 160 feet. The conditions as to water were just the same as the other. It was in the same formation. As I now remember, we started that in 1908. I saw this tunnel last fall. It was not wet, it was dry.

I have known of a spring in that vicinity since 1897; the Marble Quarry spring. That spring did not contain flowing water last fall. It did before. The water poured off the hill and flowed past the lower tunnel and into Snake Creek. I never knew it to be dry before last year.

There was another small spring on the north side of the creek which we used water out of for domestic purposes. It always run in the fall. I have never seen it dry until 1914.

In going up and down the canyon I crossed Snake Creek at the crossing by the Snake Creek tunnel, and we had to cross the creek in two places to get to our cabin with a wagon with supplies. While I was working in Snake Creek canyon and travelling up and down I observed the flow of water in the Snake Creek channel. I noticed a decrease of water flowing at the crossing in the fall of 1914 as compared with former years when I crossed it; a considerable decrease, I would say there was more than half of the water gone. I have always been under the impression that there was more water flowing in the Creek at the lower crossing than there was flowing by my workings.

Cross-examination:

I have observed the flow of Snake Creek on account of the liti tion between the Mountain Lake and the Midway Irrigation Co pany; that caused me to watch it. I was not a witness in that ca All I have done is to look at the stream as I crossed it.

116 I first noticed a diminution of the flow of Snake Cre where the road crosses above Lavina Creek in Novemb 1914. You could not help noticing the water being low. I was this crossing in December 1913. At that time the creek was flo ing a good deal more than in November last. I stated I thought was less than half in 1914.

Frank Wentz, recalled by defendant for further direct exami tion, testified in substance as follows:

During my former testimony reference was made to two oth measurements made by Call and Barzee. These measurements a on pages 21 and 22 of Exhibit 6, Mr. Barzee's book. The first w made on July 9th, 1913, of Lavina Creek. It was a float measu ment and showed 5.978 cubic feet per second. The next was Springer Spring and showed 3.11 cubic feet per second, which w also a float measurement.

Alfred L. Alder, recalled by the defendants for further dire examination, testified in substance as follows:

I have raised stock for 27 years in the White Pine country a in the head of Snake Creek; across this country shown in Exhib 1. I was on the range every year with the exception of two.

I made a trip over those localities on the 30th of last October wi Gottlieb Buehler and John Clayton to determine what the cond tions of waters upon the surface were today, compared with wh they were during the years 1908 to 1913. We visited places whe we knew there were living waters in the years mentioned; we aime to visit all of the springs in the district. We found the spring b the Heber C-ty mine absolutely dry. I saw it in October 1914 an it was dry at that time, but I never saw it dry before. This sprin is in Snake Creek canyon; it is the result of several small stream the head waters of which come out high upon the mountain nea the ridge. Before the year 1914 it had always flowed as far bac as I knew it.

The next we visited was a little spring that lies between the Hebe City spring and the Spring Branch spring. I never heard a nam for it. It came out upon the hill. It was absolutely dry. I sa it dry in 1914 but never saw it dry before.

We next visited the Marble Quarry Spring at the head of th Spring Branch; it was dry. It was dry in November 1914 and tha was the first year I ever saw it dry.

117 We then went to what was known as a little bench to th right of the Spring Branch. It was very swampy, had wi lows in it; was almost a bog hole covering about an acre. It showe

no signs of moisture whatever. I never saw any moisture there after 1914. In 1915, 1916 and 1917 it was dry. It had changed from a swampy willow-growing land to dry land. In the fall of 1913 it was still wet. It was always wet as far back as I remember.

We then went to our tunnels. They run along that bench; the wet bench I have described, right on the bank of Snake Creek, about 1,500 feet below the Mountain Lake tunnel. The name of the claim is the Tantamount. On the north side of the canyon we had three tunnels. They were all dry. In 1915 and 1914 they were dry. In 1913 they were wet. Between 1897 and 1913 the tunnels were always wet and water run out from the portal. We always had to wear gum clothes or get wet while working. A small stream flowed out of those tunnels up to 1913, except from the Combat which caved in before 1913; until it caved it was in the same condition.

From there we went up the canyon to what is known as the Hackett Springs, near the divide into Big Cottonwood. There was a small bog hole but no running water. Prior to 1913 the Hackett Spring was always a living spring, containing a nice little stream for stock use. It run for a short distance until it struck the brow of the hill and in the latter part of the season it usually sunk among the big boulders and disappeared. In 1916 the waters at the extreme head ran a little ways but not very far. In 1915 it was about the same. The first decrease I noticed was in 1914. It did not run as far down the hill as it had been running, there was less water. Prior to 1914 where it went over the hill there was such a stream that stock could drink from it, and stock did drink from it; we used it for our stock. I think stock could have watered there as far back as 1915. In 1917 I could not water my saddle horse there.

We then crossed over the ridge into what is known as Caribou. Prior to 1914 Caribou Spring was always a live little spring that ran through the basin until it broke over the brow of the mountain, then it would disappear like the Hackett spring. It is marked upon Exhibit 1. In 1914 it did not come down the canyon as far as in 1913. The only water I found in Caribou late in the fall of 1915 was a little pool at the extreme head. Every year before that there had been a running stream. In October 1917 it was absolutely dry and prior to 1914 stock could water there at all seasons
18 of the year. In 1916 they could not in any numbers. No stock could water there in 1917.

From this point we went to the head of Lavina Creek canyon. The canyon at the head has a steep fall. There was no spring there. There had been and we called it Lavina Spring. It is marked Lavina Spring on Exhibit 1. I noticed that spring go dry in 1914. In 1917 it was absolutely dry. Prior to 1914 there was a nice little stream there. Prospectors piped it away for domestic use.

I remember the culverts, perhaps 1,500 feet below the Mountain Lake tunnel, where the three marks are made diagonally across the lines representing the bottom of Snake Creek canyon marked "Culverts" on Exhibits 1, 3 and 4 (boxes practically 12″ square).

CLOSE IN CENTER

They were put in in 1906 or 1907. Prior to that time the road fro the Mountain Lake tunnel went across the country where those cu verts now are and it was very wet, the ground was full of water an the road was soft throughout the year. It was always in the san condition until they changed the road and put in these culvert In October 1917 when we were there it was absolutely dry. The was about an acre of that swampy country. It has always been dr since 1914. This is the same wet area the tunnels being spoken ((the Tantamount and others) were driven under.

Cross-examination:

The Midway Irrigation Company hired us to make this trip o October 20th, 1917 that we might prepare ourselves to testify in th case. The trip was made expressly for the purpose of determinin if we could, how many springs had dried up.

I never measured the spring located near the Heber City min it was always a good sized little stream, a nice big garden strean It flowed in the main channel of Snake Creek.

It is the custom of the people in that district to refer to a sho stream as a spring. There were quaking asp brush five or six fe high along this stream. I saw no change in the condition of the trees. They seemed to be thriving just as they had in the pri years.

The spring that lies between the Heber City spring and the Sprin Branch, for which I have no name, flowed continuously during th years prior to 1914. We used that spring for our domestic use i the days of the Steamboat and Mountain Lake tunnels. I neve saw it dry and it flowed continuously through all seasons o
119 the year. It was a small stream; it didn't flow much vo ume. Where it emptied into the creek there was plenty o water to always get a bucket of water handy and convenient. I was what a farmer would call a small garden stream. It emptie into Snake Creek.

The waters of Marble Creek emptied into Snake Creek contin ously so far as I know prior to 1914. Through all seasons of th year there was a continuous flow of water in that gulch. There i brush and trees there. It is a brushy hill. There was not muc [different-] in volume as to that and the Heber City spring; abou the same.

I think the drainage from the swampy area of one acre around th Marble Spring was into the Marble spring and the other springs be low. So we would really call that all one spring there. We woul have no way of dividing the water of one from the other. Prior t 1914 it was so swampy you could not ride into it with the horses; a animal would stay away from it at any time of the year. It was ab solutely dry last October when I was there. The mountain willow are dying. Prior to 1914 the upper and lower tunnel that I re ferred to flowed a stream of water during all seasons of the yea The stream from the upper one would be about five inches acro and one inch deep in the center and had some velocity. The lowe tunnel flowed about the same. They were absolutely dry last fall.

We went to the head of Hackett Spring. There was a little bog hole at the head last fall, but no running water. Prior to 1914 it emptied into Snake Creek in the spring of the year but not in the low water season; then I think, the spring would flow about 3,000 feet before it sunk.

I think it is over a mile from the head of Hackett Spring to the point where it would empty into Snake Creek during the high water season. The largest volume of flow, in the 3,000 feet where it crossed the little flat, in my judgment, would be about two second feet of water.

Prior to 1914 Caribou Springs emptied into Snake Creek in the early part of the season. I have never seen it reach the creek in the fall. Before that year, I would say there was a continuous flow from the spring at all seasons of the year for 3,000 feet. I never saw it dry before.

Prior to 1914 there was no time of the year, that I was there, that Lavina Spring was not flowing. Down at the base of the hill on the trail there was always a little spring where we watered. That spring was dry in 1914. I haven't been at the head of La-
120 vina Creek for many years. There was no sign of water at the head when we were up there last October. We crossed the gulch at the extreme head and there was no water flowing there. I never saw any volume of water flowing from that little spring. There was another little spring down below that the mines there used. Those two springs had gone dry.

At the other places where I saw springs had gone dry, all indications that springs ever existed there are there now. These indications are willows that have died for lack of moisture; some are not yet dead; there is the broken ground, showing old moss beds and the sod at the head of those [spring-]. That would be the condition especially at the Hackett and the Caribou and at the head waters of the Marble Quarry.

I remember that the culverts, I have referred to as indicated on Exhibit 1-*a*, were put across the road after 1906 or 1907. Up to 1914 water flowed through them continuously during practically all seasons of the year.

The water from all of these springs I have referred to, except the Lavina Spring, would in connection with Snake Creek, pass the mouth of the Snake Creek tunnel. The water from Lavina Spring would flow through Lavina Creek just above the tunnel in its natural course.

I am a director in the defendant company. It is my recollection that I was elected in 1913 and have been a director ever since.

JOHN CLAYBORN, a witness produced by the defendants, testified in substance as follows:

I have lived in Midway 44 years; as a farmer and raised stock. I was familiar with Snake Creek canyon in the 80's. I was appointed to go up with these witnesses in 1917 for the purpose of seeing those springs.

We went to what has been designated as Heber City spring. have just a slight recollection of that country in the 80's. I belie there was water there. The country we went over was all dry. saw where there had been a water channel. I knew it was a wat channel by moss and other stuff and where water had been runnin down into the creek. I heard Mr. Alder describe what they call th Spring Branch. I was with him there. I knew the Marble Quarr spring in the early days. I was not at the head of the Marb
121 Quarry spring in October 1917, but I was at the channel an there was no water there. I remember the flat which M Alder referred to. I remember that flat was there for a good man years. There was a saw mill there run by water from Snake Cree As far back as I remember, the flat was wet; the road was wet. went to the tunnels in October, 1917. I believe they are a litt above the wet flat. They were then dry. I have been to Hacke spring. In the earlier days there was water there; there was wat there in 1911. In 1917 it was dry except at the head. There was flat at the head; there was seepage there and just a very small strean nothing to speak of. An animal could not drink there. I was the Caribou Springs in October 1917. I saw evidence of springs onc being there; there is a spring bed there. It was absolutely dry whe we were there. I was at the upper reaches of Lavina Creek in earlie years. There was then a spring at the head of the canyon. I wa there in October 1917. I recognized the place where the water wa in earlier years. The place was absolutely dry.

Cross-examination:

I saw those springs in the fall of 1880. I was at the Hacke spring in 1911 and I went back there last year. I do not have distinct recollection of everything I saw in 1880.

Redirect examination:

I have a recollection of the waters I saw there when I was up ther in the 80's when I hauled cord wood; I watered my horses fron Lavina Spring.

Recross-examination:

There was water in most of the places in 1880.

GOTTLIEB BUEHLER, a witness produced by the defendants, testi fied in substance as follows:

I have lived in Midway 46 years. I am a farmer and cattle raiser I have a recollection back 35 years. I have been familiar with th country about Snake Creek every year, except the years 1895 and 1896.

In 1903, 1904 and 1905 I freighted; hauled things up for th Mountain Lake tunnel from Midway; mining supplies. Those trip would take me up the main branch of Snake Creek practically to th

head of it, following the canyon of Snake Creek all the way.

122 In October 1917 I was appointed to go up and investigate conditions. I knew what has been called the Heber City spring. In years gone by it formed a branch of running water. In 1917 it was perfectly dry. It was dry in 1914. I never saw it dry before. There was always a substantial stream of water running there before 1914.

We went to the mouth of Marble Quarry springs in 1917. They were absolutely dry. I never saw them dry before. At any time I ever saw them before there was a subs-antial stream coming from them, running down the gulch. You could have watered stock there readily.

We went to the Hackett spring. There was just a seep there. We could not water our horses at noon. I have seen it many times, but never saw it dry before. In the years before, it flowed from the head over a bluff and ran down grade 3,000 or 4,000 feet down the canyon in the low water season. It was a stream where you could water stock readily in considerable numbers. We went to [ehat] is termed Caribou Springs. They were absolutely dry. I do not know that I ever saw them dry before. I have been there before, but not as frequently as to the other springs. When I was there before it would be prior to 1913 or 1914. Before that time there was a stream of water running down the gulch from which cattle and stock watered readily in considerable numbers.

We did not go right to the head of Lavina Creek but went to where the road crosses the creek. I have known that section of the country for years back and in those years there was a stream of water running across the road there. In October 1917 it was absolutely dry. I do not know that I have ever seen it dry before. I was there in the years prior to 1914.

I remember the location of the Tantamount and other tunnels. I was there in October 1917. I do not believe I was ever there before. In October 1917 they were perfectly dry. I remember a place on top of a little bench just north of the Tantamount tunnel that was very wet. It was always swampy when I was working up there. In October 1917 it was perfectly dry ground.

In driving up to the Mountain Lake tunnel in 1902, 1903, 1904 or 1905, my recollection is that I crossed three places where water flowed across the road. I freighted all summer, until the snow drove us out. Where the road was wet before, it is perfectly dry

123 now. In those places where I used to cross they were wet all seasons of the year.

Cross-examination:

I saw two springs dry in 1914, and the next March I came into court and testified in this case, and knew what the issues were between the parties. Alder also testified at that trial, and I heard him testify, and I went on the stand and testified about these two springs being dry in 1914. I don't remember whether I called my counsel's attention to it or not; I might have done.

I am a director of the defendant company and have been for number of years. I take an interest in the affairs of the compan and in this contest. I was one of three to make this special tri last October, 1917. I participated in the trial in 1915 and helpe our counsel prior to that time with other members of the organiz tion. I was up the canyon in October, 1914, and saw two spring dry. Four or five months after that I went upon the witness stan and testified for my corporation to keep the tunnel company fro getting these waters. I knew it was important to establish that th springs up there had dried since the tunnel was run. I did no insist that our counsel ask me about these springs drying up i 1914 because there were other men looking after it. I think other besides Mr. Alder testified as to those springs at the last trial.

I do not know what has become of the old reports respectin measurements of water and land. I do not know where those record are. The Board of Directors never directed anybody to destro them to my knowledge. I do not know anything about where th records of the company are filed, except with the secretary as a rul

Q. Do you know whether or not any measurements were made o this water by the Board of Directors and under the direction of th Board of Directors way back in 1895?

A. There has been measurements made but I couldn't state as t years.

Witness, continuing: I remember when I took over the water from the Ontario drain tunnel; I can't tell the year exactly, but remembe the mass meeting and the officers of the tunnel company being there and talking to us and explaining the proposition. I don't remembe that the company was anxious to get more water.

124 Mr. MacMillan: I ask counsel at this time to furnish us th report of the committee which was appointed in 1895 t measure the waters which were owned by the Midway Irrigation Company and which was reported back to the Board of Directors a the time Wooten was president of the —— company. We ask him also to furnish for us the report which I referred to in the minute book yesterday of the classification and distribution of the waters among the stockholders, a written report filed with the company re ported to the Board of Directors. Also the measurements of land of the various stockholders of the Midway Irrigation Company which was made by committee appointed by the Board of Directors for the purpose of settling and determining among the stockholders their rights as to the waters coming from this stream now in question.

Mr. Wedgwood: I have handed everything over very freely that we had. This, of course, as the court can well see is a crude farmers' corporation and always has been. The Secretary has been instructed to make every effort to find every paper that he can, and we will produce without subpœna any man or officer that we can get our hands on that counsel wants in regard to any of these matters.

I want to make one suggestion. It may be possible you might find some of these papers you suggest as exhibits in the case of Wasatch Irrigation Company which was tried about 1904 or 1905. Thurman & Wedgwood represented some of the parties. That was a suit which

involved all of the waters of the (Provo) river at that time and you might find some of these papers as exhibits in that case. I cannot give you the full title but I can loan you the brief if you desire; very glad to let you have the bound copy of the briefs.

The Witness: I remember something of an occurrence where stockholders of the Midway Irrigation Company turned the Snake Creek water back from the Provo river into our system after trial of this case. I think three of our company were present at that time.

I had no fire arms with me. The man that was using the water that was taken from him when he was in the field had a rifle with him. He did not point it at one of the employees of the plaintiff while I was present. The water was turned back into our system by the watermaster. I do not know whether it was diverted into the Provo river at the time our stockholders took it back. I cannot tell you the year it was done, but I think it was after the other trial.

125 The testimony of the witness given at the former trial received in evidence without objection.

Redirect examination:

I was in the Snake Creek country last Sunday. I went up the road as far as Marble Quarry springs. I crossed the Heber City spring at the mouth of the Heber City tunnel where those three culverts are and up to the mouth of Quarry Spring just along the road. I found a little water at the mouth of Marble Quarry spring crossing the road. It was not but very little.

Near Heber City spring there was a little water crossing the road. The tunnels were dry. The country where the culverts cross the road was perfectly dry. There was lots of snow and it was melting that day.

Frederick Raymond, a witness produced by the defendants, testified in substance as follows:

I have lived at Midway about 25 years, with the exception of three from about 1900 to 1904. My business is that of farming and cattle raising and I am a stockholder in the Midway Irrigation Company. I get my irrigation stream during the early water from Pine Creek, and the latter part of the season from Mahogany springs. Personally I have used water from Pine Creek for irrigation for about fifteen years, in connection with my father I have used it for thirty-three years.

I have noticed a difference in my supply of water for irrigation in the early part of the season from what I have had before. The first time I noticed this water lessening was in the early part of July, 1914. I had less water then than I had the years before.

As a rule the water of Pine Creek will go down to less than an irrigating stream in the latter part of July or the first of August. Years ago my father, with another man, made a ditch from Lavina Spring over the ridge into the White Pine and it had been their

custom, when the water was down to less than an irrigating stream in White Pine creek, of going there and turning the water from Lavina Spring into White Pine Creek; and by this source we were able to hold up our water in the latter part of the watering season. The spring that has been testified to as Lavina Spring is the spring I mean.

126 In the latter part of July, 1914 we went to the point where this ditch comes from Lavina Spring with the intention of increasing our stream below and on arriving there I was disappointed in not finding any water where other years I had been able to find water at that time of the year; there was not water enough to start through the ditch. It failed entirely between 1913 and 1914. I had it in 1913 and noticed no diminution in that year.

In 1915, about the same time of the year I made the same trip expecting to get water and was disappointed again the same as in 1914. There was just a little stream from Lavina Spring; not enough to get through the ditch. We did not get any water from there in 1916. I was there myself and in 1917 I was there, and found the same conditions as in 1914, 1915 and 1916, it was dry. By some means or cause I have been entirely deprived of the waters of Lavina Spring since 1914, including 1914.

Cross-examination:

Mr. Wedgwood: May it be stipulated and agreed that the decree in the case of Mountain Lake Mining Company vs. Midway Irrigation Company as finally entered after the decision of the Supreme Court was in favor of the Midway Irrigation Company and awarded them all of the waters flowing from the Mountain Lake tunnel, or shall I get a certified copy?

Mr. MacMillan: That is all right. I understand the record in the case is already in evidence here.

Mr. Wedgwood: Yes, the whole record was put in here, abstracts and briefs.

Mr. MacMillan: There was one witness who made measurements of the Mountain Lake tunnel who died, Searle, and that evidence was referred to and used in the arguments.

The Court: Do you want that same understanding now?

Mr. MacMillan: Yes, that is the understanding.

The Court: In a case of that sort I will expect counsel in their brief or abstract to call attention to what you rely upon. With that understanding the record may so show.

127 The Witness: The ditch from the spring I think was between a quarter and a half mile long and wide enough to carry a good large stream. It crosses over the ridge and runs from the ditch down the hollow. I would judge it would be a mile or a mile and a quarter to where the water enters White Pine Creek.

Frank Wentz, recalled for further direct examination, testified in substance as follows:

Proposed Exhibit 111 is a table showing the discharge of Snake Creek at the lower end of the Snake Creek water shed, including the water from the tunnels and it also shows a comparison before and after the flow encountered in the tunnel in 1912. By "at the lower end of Snake Creek water shed" I mean near the mouth of the canyon, taking in the main channel of the creek and the diversions on either side near the mouth of the canyon, it would be at the point which has been termed the orifice of the canyon on Exhibit 1-*a*.

At the top of the table is given the months of the year and the mean to the observer, and along the left side of the table is given the year and following the year 1910, to the right is the averages and also the average eliminating the high measurements of 136.62 second feet. Following are the years 1913 to 1918 and also the average from 1913 to 1918 carried across the table; then the difference is given eliminating the high measurement of 86.65 second feet; then the difference is given eliminating the high measurments in the first period of 136.62 second feet and the average is given eliminating the two high measurements. The two high measurements I eliminated because they are both high water peaks and seem to be abnormal. If they were included it would show a greater average loss and a greater mean flow.

There are no measurements for any month in the year prior to July for the years prior to 1913. After 1913 there are measurements for May and June. Those two months are generally the high water months, particularly June.

If measurements had been made in May and June before 1910 I think a high loss would be shown. I selected and took the average before 1913 and after 1913 because the table is made up to determine the average quantity before the main flow of water was encountered in the Snake Creek tunnel as shown by the hydrograph in
128 1912.

Proposed Exhibit 112 is a table showing the discharge of Lavina Creek. The mechanical make-up of the exhibit is the same as that on Exhibit 111. The mechanical make-up of proposed exhibit 113 is the same as that of 111. The mechanical make-up of proposed Exhibit 114 which is Springer Spring is substantially the same as that of 111.

I am familiar with the location of the north side of Mount Timpanogas and of the north side of the shed of the south fork of Provo river. I think the snowfall is heavier in these two places than at others. The east side of the Snake Creek shed is practically in the same parallel line with these two sheds. This is shown on Exhibit 47-*a*. The course of the range from Clayton Peak across the divide to the head of the south fork and also Timpanogas I shade in red on Exhibit 47-*a*, by a straight broad red line, and also of Snake Creek canyon. The distance from the Snake Creek shed to the south fork is approximately 14 miles and from the Snake Creek shed to the north fork shed is approximately 14 miles. Mount Timpanogas is at the head of the north fork shed.

From my observation these three exposures show substantially

the same results as to excess precipitation over other places in their immediate vicinity.

Exhibits 111, 112, 113 and 114 offered in evidence.

Cross-examination:

In taking my averages for instance, 112-*a*, I show in 1914 a measurement in August of 8.36; I show two measurments in November of 4.39 and 4.36 and a mean of 6.39. In order to obtain that mean I first averaged the two measurements of November and then took the average of those two measurements with the August measurement and taking the average of the two produced the result 6.39 as a mean. That would apply all the way through.

The measurement of 86.65 is made up of a number of measurements made by me, all current meter and weir measurements as accurate as science has been able to develop a method for measuring water. The measurement of 136.62 in 1907 was a float measurement. I understand Mr. McCall used the float and weir measurement altogether.

I took these figures from the testimony as it was read here and checked part of them up with the transcript.

Assuming the measurement of 136.62 is float measurement and the highest measurement that appears, and knowing that the measurement of 1917 of 86.65 is a current meter measurement,
129 I think it is more than fair to eliminate the 86.65 along with the 136.62 because the comparison shown in both instances and the elimination in the first period is greater than the amount of the elimination in the second period. I think the measurement of 136.62 is a measurement that should be taken into consideration in this case. I think there was that much water at that time; I think it is nearly accurate. I think a float measurement can be taken within five per cent of accuracy.

Q. Notwithstanding an exhibit that you bring into court yourself states right upon its face that these float measurements are inaccurate?

A. In a way.

Redirect examination:

That measurement of 136 feet was in 1907. The record shows that the whole Provo river system was high at that particular time.

I made observations of the Snake Creek flume on May 24, 1918, as to the surface velocity of the flow and the average mean velocity. I made 28 observations of the velocity, four in depth in each section and divided the section into seven divisions of half a foot each. The average mean velocity of the whole flume is practically three feet per second. The highest velocity in the flume is 3.79 feet per second.

Taking 80 per cent of the 3.79 would give a velocity of 3.03 feet per second or .03 of a foot per second different than the mean velocity.

Recross-examination:

I made this experiment to determine what relation float measure-
ents were to current meter measurements, that is, by deducting
0 per cent from the highest velocity; making the comparison with
ie deductions made by Mr. Call and Mr. Barnes because they used
20 per cent deduction. I would say it was a proper deduction to
ke the 80 per cent from the fastest float.

CALEB TANNER, recalled by the defendants for further direct ex-
mination, testified in substance as follows:

I spent the 22nd, 23rd and 24th days of May (1918) in the drain-
ge area of Snake Creek making observations of the character of por-
tions of it. The drainage area was practically denuded of
30 its snowfall; the slopes in favored localities facing part of
the north had still a snow blanket with fair continuity up
wards the higher parts, particularly in the vicinity of the Moun-
in Lake tunnel, but towards the Snake Creek tunnel more or less
terrupted even in those favored slopes.

On Lavina Creek no snow was observable on either slope; no snow
ppeared in Pine Creek canyon. The run-off from the snow fall
ft would be relatively very small.

Mr. Wedgwood: I would like the record to show that we have no
ersonal knowledge by observation of the tunnel itself beyond the
),600 feet.

Mr. MacMillan: I will admit you have no knowledge from per-
nal observation beyond that point but I will not admit that you
uld not have gone into the tunnel and observed it; we would have
en glad to grant permission and the conditions are such that you
uld go.

Mr. Wedgwood: As to that, I do not care.

The Witness: I visited the dump of the Snake Creek tunnel and
served the rock which constitutes same; the mechanical quality
d the chemical composition of the material that was there. I
und a diversity of character of material. There were limestones
d quartzites; there was a fair measure of decomposed rock and
ere were occurrences of igneous rock. By igneous rock I refer to
ch as I have heard described in the evidence here as diorite or
rphyry. Generally speaking, the slope of Snake Creek canyon
epens as the canyons is ascended. As far as I know, the canyon
what is commonly termed a refilled canyon; I observed no places
here Snake Creek was running upon bed rock, the snow covers
e channel above the Mountain Lake tunnel.

Snake Creek canyon is a canyon of erosion; it is deeply cut into
e rock formation. Immediately following this period of maximum
cision, either the water supplies were reduced or the quantity of
levris] fed to the stream was so greatly increased that the carry-
g power of the stream was unable to maintain the canyon clear;
cumulations were made there of considerable depth so that par-
ularly in the lower reaches of the canyon there is a relatively flat

area in the bottom where the natural rock bed will slope to the intersection of the planes on either side to make a fill. The wider the section is the deeper the fill.

131 Where the fill is coarse material, resting on bed rock, the interstices are all filled with water before a perennial stream can be maintained on the surface of the fill.

As to exposure of the formation, there would be no difference between the gash made by erosion and an artificial gash made in the mountain by the driving of the tunnel, except one is exposed to the surface on one side and the other is enclosed in the rock completely; there would be no difference in the cutting of the cracks, fissures, joints and seams and in the lay of the rock in places whatever that place may be.

In going up Snake Creek I observed three small surface flows into the creek and one fairly large one from the Mountain Lake tunnel. I remember the three culverts in the road about 1,500 feet before you reach the Mountain Lake tunnel. I observed the condition of the ground there and it was dry.

I went up Lavina Creek from its intersection with Snake Creek. It is refilled for approximately half a mile above such intersection; then for a considerable stretch it is at bed rock, then a very slight fill and alternating with a thin fill in the canyon with an exposure of bed rock and it continues for approximately three quarters of a mile when the fill is continuous as far as I went; the canyon slopes, being less precipitous and bed rock not appearing in the bed of the creek.

The visible sources from which Lavina Creek derived its tributary surface waters was entirely from outflows from the adjacent valley fill or the breaking of springs from the solid rock; I recall twelve or fifteen in number of this character.

The character of the rock exposed in the gash or canyon through which the stream flowed where bed rock was exposed was diverse. There were quartzites, then limestones, and quartzites again. The flows of water were larger in volume in the quartzite sections than in the limestone. The rock wherever I observed it was fractured and generally very intimately broken, the general condition being larger fractures upon which had been imposed the more intimate fracturing, so that by taking up a piece of rock it could be reduced to very fine fragments. That condition was general where I had a chance to observe the gash in the hills made by the stream. The rock I found on the dump of the Snake Creek tunnel had the same characteristics generally speaking.

I have only a judgment in general as to whether or not the
132 streams belonging to the Provo river system gain in quantity and volume in excess of surface tributary supply. I have specific information upon the channel of the Provo river and for its flow of seventy miles, it is an augmenting stream from its head to its discharge into the Utah valley. It increases in flow in addition to the total volume of the inflowing tributaries. If any section of the river be measured at the head and lower end of the section and if the surface inflows between the ends of the sections be measured the

flow at the lower end will be greater than the flow at the upper plus all the tributaries, indicating that there are increments or inflows into the stream channel in that portion of the channel occupied by water bodies.

The canyon or gash in the hills through which Lavina Creek flows is one of erosion. The canyons tributary to the Provo river system generally are canyons of erosion. Provo river continues to flow after the melting snows are entirely gone from all of its tributaries. That would generally be after the first of August and the same is true of its tributaries, including Snake Creek.

The approximate mean flow of the Provo river during the month of August, after its surface supplies of snow are exhausted, at the mouth of Provo canyon is about 300 second feet. The source from which that continuous supply of substantially 300 cubic feet per second, from August until the surface supply is again available, comes out of the ground and out of the rocks. Generally speaking, the same condition exists as to all of its tributaries. The contribution from rain fall is a very infinitesimal part of the flow.

When you get into that part of Lavina Creek canyon where bed rock is exposed and where the walls run steeply, there are two principal water supplies, one coming from the right and one directly down the canyon at a high elevation. I was at the Mountain Lake tunnel. Assuming that water that now comes out of the tunnel, came out of springs, substantially 1,500 feet higher up the canyon, before the tunnel was driven, there would be a general similarity between the head of Snake Creek and the head of Lavina Creek.

I observed Caribou gulch near its intersection with the Snake Creek channel and its general course up into the hills. It would be a fact, if considerable streams of water flowed down the Caribou canyon in former years, that there would be a general similarity between the head of Snake Creek, Lavina Creek and Caribou canyons.

133 Identifying Lavina Creek, Caribou gulch and Snake Creek on Exhibit 1-*a*, and speaking illustratively, those three gulches and creeks form a fan, Lavina Creek and Snake Creek being the outside radii of the fan, and Caribou gulch would represent a radii substantially in the center of the other two. It having been shown that the Snake Creek tunnel crosses Caribou at two places as indicated on the map, Snake Creek tunnel would also be a radii of that segment of the circle substantially in the center between the two outside radii, Snake Creek and Lavina Creek.

Mahogony Spring is located near the east quarter section corner of Section 21 on Exhibit 1-*a*, Township 3 South, Range 4 East. Springer spring is located near the northwest corner of Section 21 in the same township and range.

I have marked on Exhibit 1-*a* the word "Spring" and a star on Lavina Creek. Mahogany Spring would be between 1,500 and 1,800 feet lower in elevation than that point. Mahogony Spring would lie about 1,000 feet in elevation below the Snake Creek tunnel. Both Springer spring and Mahogony spring lie further down the canyon than the mouth of the tunnel. Both Springer spring and Mahogony

spring come out of the nose of a divide where that nose enters the flatter country, near the orifice of discharge of this drainage area. The tunnel comes out of the nose of the divide between Snake Creek and Lavina Creek, being higher in elevation than the intersection of the two streams.

I have examined Exhibit 22, the hydrograph of Snake Creek tunnel showing the water flow from the mouth of the tunnel as water was struck in different places in the tunnel, to where it was 10,600 feet to the face. If we assume the hydrograph correctly states the facts as to the flow into the tunnel and out of the tunnel during its two miles in length, and that within the tunnel the walls and the back and the floor, so far as exposed, show the formation to be crushed from a point approximately 2,700 feet in to the face, and that at intervals there are openings varying in size that will permit water to perceptibly flow and run, and others varying in width from half an inch up to two feet, and these openings striking across the tunnel at from right angles to a northerly and southerly course of a few degrees, and a few of them stand vertically, a portion of them dipping towards the mouth, some dipping the other way, coupled with my observations of the dump, my observations in Lavina Creek canyon and upon Snake Creek, and also with the fact of water issuing from the Mountain Lake tunnel, and also the fact that
134 the springs at the head of Caribou Creek had become dry
since the tunnel was run, and that Lavina Creek and Snake Creek have failed in their flow exceeding ten per cent, and figuring the configuration of the country in this fan shape as indicated, my judgment is that the country lying between and within that fan shape is broken, seamed and cracked in more or less open ways similar to those developed by the tunnel. My judgment is that the country below the orifice of the tunnel is practically the same as to that condition as the country lying above the tunnel.

Taking into consideration the fact of the diminution of the supply of Lavina Creek, Caribou and Snake Creek and the absolute cessation of flow of Heber City springs, Marble Quarry springs, the ceasing of water to flow in the tunnels that were mentioned in the evidence and the drying up of wet boggy marshy places on the borders of Snake Creek, so that they are now entirely dry, even in the early spring of the year, and also taking into consideration the discharge of water of both the Mountain Lake and Snake Creek tunnels, my judgment is that that broken open condition of the country furnished free open passages for the carriage and transit of water.

If we were to ignore the diminution in the volume of Snake Creek and also of Lavina Creek, my conclusion would be the same from the other evidence. In my judgment the fact of water coming out of the head of the three canyons, Lavina Creek, Caribou Creek and Snake Creek at high elevations and of water issuing out of Mahogony springs and Springer spring at low elevations, shows that the country is generally traversed by waterways through which the exit of the water can and is made at both the superior elevation and the inferior elevation.

The geological history of that country is derived from the investi-
ation and reports of the United States Government and published
the survey of the 40th parallel and the survey west 100th meridan
d in special publications aimed toward the explanation of this area
its geological relation made by the mineral divisions of the Geo-
gical Survey in more recent times. The most intimate investiga-
on has been made in what is designated as the Park City area.
hat includes a portion of the Snake Creek drainage area as indi-
ted on Exhibits 1 and 1-*a* with reference to the crest of the ridge
tween the drainage area of Snake and a portion of the Weber.
xhibit 4, known as the Park City Special, is the base of the
work.

5 Proposed Exhibit 115 represents some of the features on Exhibit 4, some of the features on the westerly two-thirds of e Park City sheet is shown as contained in sections 16, 20, 21, , 29, 30, 31, 32 and 33 and in Towships 4 south and 5 and 6, and fringe off the southern end of those sections in the next township the south.

The features on what is know- as the Cottonwood special that late to the Snake Creek drainage area are assembled on Exhibit 15. The red line on Exhibit 1-*a* with reference to the northern undary is indicated by a heavy black dotted line along the general estern boundary of this exhibit. With reference to the scale or e of the map, to the Park City and Cottonwood Specials, the scale doubled.

Proposed Exhibit 116 forms a part of the report I refer to and connected with the Park City Special on Exhibit 4. It is a ap of a level in the Ontario, Daly, and Daly West mines showing e fissure vein system and geology in part. It has been partially produced on Exhibit 115. It is the [dotte*n*] parallelogram tuated in sections 28 and 29 as shown on Exhibit 115. North is dicated on Exhibit 116 by the arrow drawn in ink. The same row is shown on Exhibit 115.

The geological history of that district shows that the area has en faulted in a great degree and fissured and fractured in rather intimate degree. The fissure shown in the Ontario and Daly est is traceable to miles in extent. In that particular district they ve been in a measure refilled by ore.

The fissuring upon one level of the mines is indicated on Exhibit 16 by the red line which runs within the two parallel dark lines d which in the legend is shown as a fissure zone. These have en reproduced on a diminished scale on Exhibit 115 by the pink e running in a general east and west course across the paralle-ogram sections 28 and 29.

As shown by the scale, the most of the fissuring is about 950 et from the backbone of the divide; that is only illustrative, that all. The no-ther-most of the fissures shown on the exhibits is a tle more than a mile from the divide in its shortest distance. The me geological history shows fissuring and fracturing upon the ake Creek side of the range at points respectively marked 49 West uincy shaft in section 32, 9-1, south of Lone Hill as marked in

sections 33 and near 20-2, 20-3, 20-1 in section 4, and between the points marked 37-1 and 37-3 in section 5 as shown on Ex-
136 hibit 115, as fixed lines in the same order as just announced: West Quincy shaft; South Quincy; Superior; Latersall.

There is another geological map connected with the Park City Special, which so far as outline is concerned is practically a duplicate of what we commonly call the Park City Special, Exhibit 4, and made a part of the report I speak of, it is on page 44 of the book. The designation by numbers I spoke of on Exhibit 115 are illustrated upon this map.

Snake Creek tunnel is indicated on Exhibit 115 by the bright colored line reaching from the northeast quarter of section 18 up to Clayton Peak and thence going off to the right, turning 65 degrees to the east, a distance of 1,700 feet. It was put on from the data given by Mr. Friendly yesterday. The Mountain Lake tunnel is also shown upon that plat and is substantially one mile in length.

On the map, on page 44, the geology of the area, that is, the kind of rocks and the age of the rocks in their geological significance, is shown in addition to what is shown upon the Park City Special, Exhibit 4. It shows that all of the area that has been spoken of as the Bonanza Flat country is covered comparatively deep with drift. Bonanza Flat is written on the map near its southern part; a buff color is generally present there; that color in the legend is marked "till" which has the geological significance of being the deposits of glacial action. That locality is indicated upon Exhibit 115 by the same legend, "Bonanza Flat." In the middle of the area marked on the map, and also on Exhibit 115, the bed rock rises in Lone Hill and also from the west and to the east.

Speaking in a general way, earth movement caused the fissure shown upon Exhibit 116, reproduced upon Exhibit 115, and referred to in the text of the report spoken of, and shown in section 5, Township 3 south, sections 33 and 32, 4 south, and section 4, township 4 South. This area is probably the most disturbed area in the State of Utah. The probabilities are that the fissuring and fracturing shown both to the north and south of the divide occurred at the same time. The earth movements in that area are not of the same age and it is a very grave question if they have ceased even now, but the same forces acting through the same time have effected both areas in practically the same way.

My judgment is that the disturbance being great would cause the fissuring in sections 28 and 29 within the parallelogram.
137 As to whether such a great disturbance as would produce the result shown within the parallelogram, Exhibit 116, could occur without creating a fractured, fissured and crushed condition throughout the area covered by the upper part of the Snake Creek drainage area—the disturbances indicated there, in conjunction with other related phenomena in the same area, would indicate that it could not have been confined to so narrow a limit. The physical conditions as I have seen them and as indicated by the data I have given upon the south side confirm that opinion.

The fissures as shown upon the north of the divide, and the major

rtion of them on the south of the divide, are generally east and st occurrences, and taking them in the large they intersect the irse of the Snake Creek tunnel roughly at right angles.

I have read the testimony of J. E. Talmage and heard it read court. I have in mind the hypothetical questions put to me in gard to fractures and openings crossing the tunnel. They conform bstantially to the facts as stated. From all the evidence [adduces] present I have the opinion that the movement must have opened e fissures, in the sense of openings, cracks, in that country lying a slightly northeast and northwest direction, that would extend roughout the Snake Creek drainage area.

Assuming that Snake Creek flows continuously throughout the ar after the melting snows are gone, in the absence of any rain hich I have said is a negligible quantity, it would get its water om the ground, and assuming there was a greater flow than the rface tributaries furnished after the snows were off, and assuming e canyon is rock filled, as I say, the additional water would come from the ground and the rocks; the direct source of supply would the outpour of water into the streamways from underground urces. They would find their way into the eroded channels in e rocks in exactly the same way as they find their way into the nake Creek tunnel.

Assuming that Springer spring shows a lose since the driving of e Snake Creek tunnel of a varying per cent up to as high as 30 er cent; Lavina a loss of approximately 50 per cent in recent years nd the Mountain Lake tunnel a loss of substantially 40 per cent, think there is no question but what the water supply is failing. ssuming the Mountain Lake tunnel condition as stated and the nake Creek tunnel striking water in 1913 and now flowing approximately 13.44 cubic feet per second, my judgment
38 under those circumstances, and with those relations, is that the Snake Creek tunnel has intercepted some of the sources f supply of the several units that have been given here as showing very material diminution in the period that the Snake Creek unnel was drawing at its mouth a large supply of water from this rainage area.

The effect of the drawing of water as I have referred to through the Snake Creek tunnel upon those conditions, would be to generally lower the ground water level and by that means not only to intercept other channels of escape directly and completely, but also to partially deplete channels that had outlets in the natural streams and springs of the area by reducing the head of the water that in a state of nature fed these natural supplies.

The geological history of the region which I have described tends to prove or illustrate my statement and to show facts absolutely in harmony with it. It is contained in the geological report to which reference has been made in several places where the subject is under discussion, the general result being that tunnels located in this area comparable, in general relation to the area they are located in, to the Snake Creek tunnel with respect to its relation to the Snake Creek drainage area,—that the territory immediately above and

for distances laterally is so denuded of its water that upon the completion of these tunnels no further difficulty is generally experienced in mining operations in the sections where such tunnels are built, whereas, before the completion of such tunnels, mining in such areas was very difficult and in some cases practically impossible on account of the immense volumes of ground water encountered.

I have in mind the Ontario No. 2 shaft where a large quantity of water was pumped at one time. That is one of the main facts I had in mind in that answer. It is said to be dusty now where four or five cubic feet per second of water was being extracted by pumps before the tunnel was built, as shown by [tye] text of the report. After the Ontario tunnel and the other tunnels on that side were driven, the history of the Silver King is that mining was carried on to great depth without interference from water. Ontario shaft No. 2 is shown on the plat near the northeast corner of the dotted parallelogram.

I would expect the same physical occurrence of the exhaustion of ground water above the tunnel shown by the facts on the Park
City side to follow upon this side of the divide above the level
139 of the Snake Creek tunnel. The question of re-adjustment is
one that can only be solved definitely by the actual experiment itself. The probabilities are that it would take a period of years for the rainage area to adjust itself to an avenue of escape of water recently constructed, or for a balanced condition of outflow to result.

Speaking in a large way, my judgment is that the flowout of the Snake Creek tunnel is very largely the waters which in times before flowed out of the Snake Creek drainage area through the canyon gorges that naturally drain that region, the supplies being from the ground through the rocks as springs and through the soil cover as seeps and springs into these natural channels; that a portion of the yearly renewed supplies of water within the Snake Creek drainage basin, sub-surface or surface, may have, by means of the tunnel, been exhausted before the low water season occurs in each year is involved as part of my answer.

Exhibits Nos. 115, 116 and 117 received in evidence.

Cross-examination:

I do not think I was ever in the underground works of the Silver King mine at Park City. I do not remember of being in any of the mines at Park City and never made any study of the underground workings there, except through the book, and such as I incidentally obtained from the surface. I studied geology at Lawrence Scientific School at Harvard from 1890 to 1895. Since graduating, my business has mainly been engineering with relation to water supply, in a very general way, and in particular irrigation.

I have done no mining to follow it up in any persistent way. I have lived in a mining camp and incidentally obtained information with respect to that matter. My time underground since I graduated would probably not exceed two or three weeks in all. I would say

that diorite is impervious to water except it is filled or occupied with fractures or fissures. Generally speaking, Clayton Peak consists of diorite.

(Exhibits Nos. 119, 118 and two marked No. 25 one 23, another 23-prime) handed to Mr. Tanner. They were rock specimens and he was asked to tell what they were.

Exhibit 119 looks like a piece of quartzite; exhibit 118 looks to me like a piece of quartzite. I cannot locate any "Spirotight" in it; my vision is not very good. I would not know it if I saw it. Exhibit 23 I would call porphyry; Exhibit 23 prime I cannot tell what it is. I have never been in this tunnel—just to the mouth of it. It is not a fact to my knowledge, either by observation or
140 literatiure on the subject, that generally speaking when porphyry is encountered, where it has been in contact with water, that it is found that it disintegrates and forms a sort of silt or material impervious to water.

Very roughly, 20 per cent of the Snake Creek drainage area shown on Exhibit 1, is included within the Park City Special.

The geological survey and report contained in the book to which I have referred in my evidence does not simply cover that portion of the Snake drainage area included within the area shown on the Park City Special. The general descriptive matter in the volume in question goes to the whole question of the area without any particular limitations as to the boundaries on the map; all of the detailed discussions however, are confined to the map.

At your request I have laid on the Park City Special the Snake Creek tunnel and Mountain Lake tunnel and put on the boundary line of the so-called Snake Creek drainage area. I have not the information to extend that boundary line very satisfactorily. On the east side it is indicated practically by the road on the Park City Special. The west side is indicated by the broken black line marked "Wasatch County" and "Utah County" at one place; at another place marked "Salt Lake County," running up to Clayton Peak. Exhibit now marked "120 plaintiff," is the exhibit on which I have made those extensions. The exhibit is made up on the right from the Park City Special and on the left from the Cottonwood Special. The portion that is pasted on to the Park City Special does not appear in the geological survey report which I referred to yesterday. Where the two maps meet divides the two different surveys. The separation is by a line of longitude, 111 degrees and 34 minutes west of the base line at Washington. The same line would be indicated on Exhibit 115 from the letter "A" in blue to the letter "B" in blue. My answers yesterday were based upon the geological report covering both of the maps that are now attached in Exhibit 120. There is no such exhaustive report in the Cottonwood area as there is in the Park City area. Such information as was available with reference to the Cottonwood area I have stated. The matter I have partioularly in mind is contained in Bulletin 620-I.

Exhibit 120 received in evidence.

I found rock on the dump of the Snake Creek tunnel which gave evidence of having come from a portion of the tunnel where
141 there was no doubt in my mind there was slickensides. To
produce slickensides, the earth must move one side on the other; that is not practicable as a mechanical occurrence without the phenomena being fairly extensive; in the neighborhood of a mile or miles. Wherever there is a slickenside, necessarily there is a fissure or fracture produced. In my opinion you would not find a slickenside without finding a main fracture extending for a distance of at least one mile.

I meant in my explanation made a minute ago that the adjacent area would have produced in it probably secondary fractures measurably parallel, or shooting off from the other but being involved with the other and could not have occurred without the main one, and along these small movements might take place and produce slickensides. The extent of the motion that might produce slickensides might be 10 feet and might be a thousand feet. I think it could be done in a movement of six inches.

The parallelogram to the east side on Exhibit 115 represents in projection Exhibit 116 as a part of the Park City Special report. It encloses the main mineralized fissures in the Park City mining district and along which mining has been prosecuted. There are greater fissures in the Park City mining district than this one. I have in mind one that crosses in a general east-west direction north, about 75 degrees west, and cuts across the country at about the collar of the Massachusetts shaft. On the surface that shows a lateral displacement of a strata of approximately one half mile, indicating a very extensive break in the crust of the earth and a very large movement along that break.

I am giving now the occurrence that is described in the report, I do not think I have ever seen it. The report shows that these fissures are irregular in width and in places are more ill-defined than in others. The one fissure itself would in its course, both in longitudinal extent and in depth, vary a great deal, running from inches up to several feet. If you would take in all the brecciated zone, it would probably be in excess of 10 feet. By brecciated zone I mean where the country has been broken into large or small fragments with numerous fractures running in all directions; it is rather a crushed zone. In the parallelogram the main Ontario fissures, the Daly-West fissure and part of the Daly-Judge, which have the same general direction and are either the same fissure or offshoots from the same fissure, are represented, they are a connected set of fissure occurrences, intercept each other.

142 The Ontario drain tunnel was run for the purpose of unwatering the ground in which mining operations were taking place. Generally speaking, it would not be necessary for the drain tunnel to cut the fissure in order to unwater the ground, but it would have to cut ground in some way connected with the fissure.

I do not mean to say that any particular fissure can be traced as an absolute identity for more than a mile or two. I mean to say

that the ground in the Snake Creek area would be jointed and it would be faulted. It is my opinion that the movement of the earth which produced the fissures in the parrallelogram extend over into the Snake Creek area. I would expect to find in the country that is cut underground by the Snake Creek tunnel, fissures similar to those found in the parallelogram. I would describe them as the same mechanical phenomena without saying that they were in extension of any particular fissures in another place.

I would say that the movement of the earth which produced the fissures represented in the parallelogram was easterly and westerly. I do not know that all of those fissures extend to the surface of the earth so that they could be traced. They may or may not. If you had a series of very plastic rock overlying a series of very brittle rock you might have a fracture that would extend through the brittle rocks and result in a flax when you got to the rocks that would bend, and never reach the surface.

With reference to the outflow of water from the Snake Creek tunnel, I think my answer was that the various openings, fractures and fissures that fed the water to the tunnel in times before the construction of the tunnel, following along the underground courses of those openings, intersected the natural drainways of the water shed and found their natural outlet into Snake Creek, Lavina Creek and the springs and seeps related to those streams and other springs and seeps in that drainage area.

Q. Let us have just exactly what your definition of such an open fissure is.

A. An open fissure is a break in the rock that if there be no ways into it and irregular, then occurs as a distinct opening of magnitude reaching through the rock. The fissures that I have in mind as being the fissures of the Snake Creek area in the section where the tunnel is constructed, doubtless have some local openings, but generally speaking, those fissures are filled more or less, and more, or less completely with material. In the case of movement along
143 fissure the dropping of the brecciated stuff into the fissure
and carrying of material into the fissure from adjacent areas, wherever the openings were sufficiently large for currents of water to be developed sufficient to float the material, whether it be fine sand or silt or material of that kind. So that, speaking in a broad way, in my judgment those fissures are not continuous, relatively open ways clear to the surface. They may be incidentally here and there open ways but generally speaking they are filled with material of various grades of coarseness and fineness down which the water moves, and their condition of porosity and the magnitude of the openings are of such largeness that they form relatively the important channels of movement of the water through the area.

Witness Continuing:

I would expect the fractured condition I referred to to extend over into the Mountain Lake district. I would expect the same general results in the Mountain Lake tunnel as is found in the Snake Creek tunnel, I said that where there is a fracture encountered by

cutting the formation by a tunnel, such as the Snake Creek tunnel, it cuts the water course so as to drain the country and prevent the storage of water which might theretofore be called natural underground reservoirs. In the large, I would expect the country, which was wet from the surface or through fissures and fractures and cut by a drainage tunnel, to be drained of water so that we would get a comparatively dry country. The outflow from the drainage area would be measurably displaced from its original position so as to make what we have defined as the high water period broader and higher, and what has been defined as the low period lower; that is, to displace the curve of outflow on the hydrograph up season towards the earlier part of the season, and to depress what we call the low water flow, and that would happen whenever a deep drainage way was made through the country, whether by a tunnel or an additional canyon. I would expect to find underground in a tunnel such as this high water season just as I would find it on the surface and low water season—a fluctuation of the flow of waters. If able to ascertain the high water flow underground prior to the construction of a tunnel, and the country be then penetrated with a tunnel and the high water season ascertained, and one were able to make a hydrograph of the bed, the peak of the high water underground prior to the time of the tunnel would be found later in the season within the peak of the high water flow after the tunnel penetrated the ground. Of course, that would be uniform in any coun-
144 try were the underground conditions the same, as for instance, the Mountain Lake and Snake Creek tunnels.

I would expect to find in such a tunnel a fluctuation of the flow of waters.

Generally speaking, if you had an upraise following along up a fissure you were mining along and that fissure developed a great quantity of water so as to make it a very wet raise and you afterwards cut the fissure by a drain tunnel, the effect would be to drain that fissure of water and generally speaking, you would expect the upraise to be comparatively dry thereafter.

My theory is that when you cut the formation of the country with a tunnel that you drain the country vertically above it and measurably drain the country adjacent to it laterally, so that I would expect all the country within the two miles of the "V" extending up from the Snake Creek tunnel would be drained by that tunnel. I do not think it would unwater the ground completely, but a very great portion of the drainage, in my judgment, fairly complete, would be made of the tributary zone that was "V" shaped and lying above the tunnel.

I do not know whether a series of large or small fissures would drain the country more quickly. The whole thing would depend upon the total cross sectional area and the finances of the material in which the water had to pass in the fissure zone. Other things being equal, fractures that are of a large dimension are relatively extensive and open ways for the movement of water, in jointing and smaller fractures the travel of the water is very crooked. Generally speaking, other things being equal, I should think a fissured coun-

try would be better and more quickly drained than simply a fractured or jointed country. You frequently find a country where there are series of small fractures without any large fractures. Where you get a country that has a master fracture in the rock, the adjacent rock is fractures so you will have double openings, fissures themselves and the fractured country which follows along the master fissure, and other things being equal that country would drain more quickly than the country which has simply the small fractures, but you sometimes have conditions present that operate, even in a fissured country, to very completely seal the fissure zone, and where that would be the case you might have the very contrary.

145 Speaking in a large way, the geological formation of the Park City district is the same as the Snake Creek district. The dip of the Snake Creek drainage area is quite variable, but generally towards the north and northwest as far as I observed. The dip of the Park City area in some places is very strongly towards the west. The dip is very much modified by the intrusions throughout the area. Around Clayton Peak there has been an up-thrust of igneous rock from the depths and the strata all around it are modified by that up-thrust.

If you draw a line east and west through Clayton Peak, I would expect to find the dip of the beds north of that line northerly, and south of that line, southerly.

I heard the testimony of Doctor Talmage and his son, and of Mr. Taylor, to the effect that the dip of the beds as cut by the Snake Creek tunnel is almost uniformly northerly. Generally speaking, the flow of the water would follow the dip of the beds unless there was some other physical fact to intercept its flow.

If in prosecuting the work of extending the mining operations along the fissures which are represented in my parallelogram on the map towards the Clayton Peak country you develop more water, I would form the conclusion that the country lying between the face of the workings and Clayton Peak was being drained, and also all country adjacent to the tunnel on either side.

If, as that work is prosecuted towards Clayton Peak and about Bonanza Flat, the water increases, I would draw the conclusion that it is draining the Bonanza Flat Country. I cannot state where all the water that comes through the Snake Creek drainage area may have come from but it is generally true from experience and investigation of the subject that the lines of drainage outflow generally conform to the larger divisions and slopes of the sheds upon which the drainage is imposed; that [*mya*] be very materially modified when the local conditions are just right.

Part of the snow which falls on the Snake Creek drainage area and percolates into the soil may find an outlet on the Park City side, or even down in the Salt Lake valley side; that is, I would not say that was absolutely impossible, but I see no color of evidence from any investigations I have ever made, or anything I have ever read, to indicate that that might be the case.

146 It would be my judgment, that if you should ascertain by mining operations in the parallelogram that as you proceed

towards and under Bonanza Flat, the water flow largely increases; that you would then conclude that a portion of the snow which falls in the Snake Creek drainage area finds its outlet through that series of fissures.

I think it would be impossible for the water which comes to the surface in the Snake Creek drainage area through springs and seeps to be the result of snow which falls in the Uintah range to the east. There is no physical connection such as would be essential to make a transit of the water such as you infer. I do not hesitate in saying, from my knowledge of the country, and I have been over it several times, and my study of the question, that that is not possible under the conditions there.

The maximum elevation of the Uintah range is 14,000 feet. The elevation of Clayton Peak in the Snake Creek drainage area is something like 14,000 feet. Snow falling there upon an elevation of 14,000 feet, percolating into the ground could not follow down under the formation in those valleys and make its appearance in springs at an elevation of 10,000 feet, because the country is broken; deep-seated fractures cross that country between the Snake Creek area.

I have seen the evidence of the fractures on the ground in the area between the Uintah and the Snake Creek. Right east of the Snake Creek area a great fault traverses the country north and south in such a way in my opinion as to cut off any kind of flow from the Uintah country into the Snake Creek country. I would not say that it might not connect with fractures in such a way that some supplies might not be made from the lower northeast corner of the Uintahs, but generally speaking for the mass of the Uintahs, I am satisfied it is an interposing difficulty that cannot be overcome for any transfer of water.

In my opinion, the fissures which are cut by the Snake Creek tunnel are filled with permeable material. Frequently, it must be quite coarse and probably there are zones where the accumulations are fine. It is my opinion that the fissures which are cut by the Snake Creek tunnel would give ready access to the flow of water from the surface and the country adjacent down to the tunnel; a comparatively rapid flow and the same would be true with reference to the Mountain Lake tunnel. I do not mean to carry the
147 idea that movement of water in the ground has anything like a comparable quantity and velocity to the movement of waters in a stream.

Q. Let us assume a country the center of which is occupied by a dome of permeable diorite; on one side of the slope the bedding is dipping towards the dome; it is cut by small fissures and fractures, some of them vertical, some of them dipping towards the dome, some of them dipping away from the dome; on the other side of the slope a series of large, long fissures extending in width at places to 40 or 60 feet traversing a considerable distance in the direction of and away from the dome of diorite, with a brecciated zone following along on either side of the main fissures, and lateral fissures and fractures

radiating out in all directions from the main fissures and fractures, some vertical and others dipping in either direction, this country being located where it would be covered with snow in the winter time from the dome on both sides, the dip of the country on the side of the dome where the large fissures and fractures are found being away from the dome; where would you expect to find the greatest drainage, in which direction in that country?

A. I would not know, under the condition you have imposed there.

Q. Why?

A. Because that would be measurably controlled by the topography, the conditions of fracture such as outlined, the breaking of the rock and the direction of the break and the openings, is not sufficient without the topography upon which these breaks outcrop.

Q. Let us assume that the topography on the side where the small fissures and fractures are found is the Snake Creek drainage area, and that the topography on the side where the large fissures are found is the same topography as that found on the Park City side of the country represented by your map Exhibit 115.

A. Well, you would have the advantage, under statement of the conditions contained in the question, of rather extensive openings and large ones leading in one direction to the northeast, which would be very favorable in that respect to drainage in a northeast direction. You would have opposed to that the advantage of the greater slope on the Snake Creek side which falls to lower elevations more rapidly than it does on the Park City side in the direction of the stated channels and fractures. I should think that under the conditions of the inquiry that even with that disadvantage the large continuous open ways would be somewhat more favorably situated for gathering and carrying away the drainage.

148 Whether in the whole, a mile of tunnel would gather more water on the Park City side than it would on the Snake Creek side I do not know, but there is existing evidence upon which a judgment in that respect might be founded. I only know that evidence in a very general way and I do not think from that evidence that a mile of tunnel in the Park City area would yield generally more water than a mile of tunnel in the Snake Creek area.

If the fissures represented in the parallelogram on Exhibit 115 extend into the Snake Creek area in accordance with the opinion which I have given and those fissures partially drained Snake Creek area before the Snake Creek tunnel penetrated that area, upon such statement of the proposition, it is my opinion that after the Snake Creek tunnel had been run into that area, it would gather some of the water which formerly drained out through these large fissures.

Locating as best I can, the fault which lies between the Uintah range and the Snake Creek area to which I have referred on cross examination and referring to professional paper No. 77 and the Park City Special on page 44, the fault I have in mind is shown in the northeastern part of the area extending down to the head of McHenry canyon, on the south slope of the Bald Eagle mountain. The fault is traced from that point, northward beyond the limits on the map, south it is very largely covered and obscured by the surface

being occupied with porphyry. Whether that connects with the fault in the extreme southeastern part the plat does not show, and the evidence does not show definitely, but it is certain that a great displacement like this could not stop suddenly at the McHenry canyon; it must have also a great extent to the south, and inferentially might leave the area somewhat in the position as the fault shown extending across the southeast portion of the map in Cottonwood canyon and tributary to Provo. The fault in the Cottonwood tends, as it invades the map, to approach a north-south direction.

Between the southerly limits of the McHenry fault and *and* the northwesterly end of the fault from Cottonwood canyon, there is a long space where no fault at all is indicated. Nobody knows definitely whether the two faults join underground; there is a distance of over a mile between them.

The fault extending from McHenry canyon is indicated by a black line partially broken and partially solid to the north of the map to the point marked "1" in pencil within a circle. McHenry
149 canyon is just northeast of the printed figures "27" in the red portion of the map and about midway between the upper and lower edge of the map and about one third of the way from the east edge of the map. The Cottonwood fault found in the lower left hand corner of the map near the word "Cottonwood" is indicated by a black line over which are the figures printed "26" and following off to the east edge of the map with a figure in pencil "2." That map is Exhibit 117.

Redirect examination:

It is axiomatic, that if a natural stream of water assumed, from time immemorial, and in later years demonstrated, to carry a mean flow of substantially 45 cubic feet per second during the summer or spring season of the year, that the quantity of water delivered by that stream in its flow is found within the surface or sub-surface drainage area of that stream. That Snake Creek channel and Snake Creek tunnel both carry water is demonstrated. It is also demonstrated that they carry water from the surface or sub-surface drainage area of Snake Creek. Whatever in a state of nature was the drainage discharged through the Snake Creek water shed, that condition was not modified in any respect by the driving of the tunnel.

Assuming that the Snake Creek tunnel drew a larger supply of water at 10,000 odd feet than it does now at 14,500 feet, the opinion which I expressed, that it would draw water from the fissures and fractures that formerly flowed into the Ontario tunnel, would be probably contrary to the fact, and yet, I think my opinion is perfectly logical along general principles.

If it is demonstrated that 13.50 cubic feet per second of water flows out of a tunnel two miles in length it is axiomatic that it must flow into the tunnel in the same quantity that it flows out. In a rough way, with a tunnel 7x9 feet in width and height of opening and two miles in length, without calculating to a refinement, there would

be seven and one-half acres of tunnel surface. With 13.50 cubic feet per second of water flowing, 27 acre feet would flow every 24 hours. Such a flow of water would be impossible unless there are substantial openings which carry flowing streams of water.

Before the driving of the Snake Creek tunnel, Snake Creek Caribou and Lavina were the deepest gashes into the mountains in the Snake Creek shed. They are still the deepest gashes in the canyon below the mouth of the tunnel. As I said before, whatever formation there may be extending easterly and westerly across the coun-
150 try is cut by these gashes as they lead down the mountain side.

The dip of the fissures in some places are shown on Exhibit 116. Wherever a red arrow accurs, the dip of the fissure is in the direction of the arrow and the quantity of the dip is given in red figures besides the arrow. The dip of those fissures is shown not to be uniform within any comparatively short space, sometimes the dip is one way from the horizontal and sometimes the other way from the horizontal. At places, those fissures dip in the direction of the sub-surface drainage area of Snake Creek as they come to the top. The dip of some is indicated on Exhibit 115. Some of these dip 70 degrees towards the sub-surface drainage area of Snake Creek and run a mile longitudinally from the ridge. This would be very unfavorable as to contribution to the Park City drainage area.

My statement in regard to drying up the area that was naturally tributary to the tunnel was not meant to reduce it to an absolutely dessicated stated or take all of the sources of supply absolutely. There are doubtless favored sections that are not tributary that might lay in the areas and relatively enclosed by the areas that were tributary. I meant that answer to be in the large and not to be to the refinement that you seem to apprehend might be imposed upon it; that was not the intention.

Recross-examination:

In other words, it does not necessarily follow that a tunnel driven into the country without any reference to the construction, quality or composition of the country, will drain the country immediately over or immediately adjacent to it.

Every black arrow on Exhibit 116, with exception of one, shows a northerly dip of the beds and the one that shows a southerly dip is found in the right quarter portion of the sheet. The red arrow indicates the dip of the fissures. It is a fact that, with the exception of the fissures lying on the lower portion of the map near the center, all of these arrows dip to the north or northerly, and there some are shown dipping to the north and some to the south. By the former answer I would mean that those fissures dipping to the south would lend a favorable avenue for the drainage of the water that comes through those fissures into the Snake Creek district. The dip of the fissures to the north would be much more favorable for furnishing a drainage to the Park City district. All of this would depend

somewhat upon the level underground at which the dips were
151 taken. The drainage of a country through a fissure, does not depend alone upon the dip of the fissure. It also depends largely upon its strike.

Before the underground reservoir in the Park City district was cut by making tunnels and workings, the ground water level of water was high on the Park City side. These workings have lowered the ground water level on that side. The lateral extent of the drainage will move as the tunnels and drainage ways are penetrated into the country. The slope of the country in the drainage area of Snake Creek I stated was much steeper than that in the Park City area. The slope of the country to some extent controls the drainage of that country through the fissures or fractures of the earth. Before these underground workings penetrated on the Park City side there was some point through which this water which was percolating down from the yearly snowfall was issuing and I think the driving of the tunnels simply changed the place of the outlet. You get a better head for any outlet on a steeper slope than you do on a gentler slope, and outflows depend directly upon the head, so the slope giving the greater head other things being equal, will have the greater outlet.

Speaking in a large way, and assuming, that the dividing line between the Park City drainage district and the Snake Creek drainage area is occupied by a mass of permeable diorite through which water will flow in either direction and that the underground water table on the Park City side was high before the tunnels penetrated in that district and that the slope of the country on the Snake Creek side was much steeper than on the Park City side, that would tend to cause a drainage through the slope of the Snake Creek side, extending through the diorite into the Park City side. Speaking with reference to that zone where the effect of these al-ernate influences would be present, as the Park City side was mined and opened by tunnels and underground workings, thus affording a favorable avenue for the escape of water on the Park City side and thus lowering as I have already said, the underground water table on the Park City side, it would tend to decrease the drainage through the Snake Creek slope, and the further underground workings on the Park City side penetrated towards and into the Snake Creek drainage area, the greater would be the drawings of water through the underground workings on the Park City side from the Snake Creek drainage zone, and that would be enough to offet the advantages of the southern slope.

152 It is not true that if any springs have dried up in the Snake Creek side that they may have been dried slowly by the further penetration of the underground workings from the Park City side. When a very large fact occurs very near to the changed condition it is logical to ascribe the modification as being materially affected by the present fact and not by the remote thing. The occurrence of the water in the Snake Creek tunnel and its outflow therefrom clears my judgment with reference to the ascribing that fact to be the agent of modification rather than occurrences and modifications that were near the summit or the divide or under the

very head waters of the Snake Creek drainage farther away from where the disturbances and modifications occurred.

Redirect examination:

The diorite at the backbone of the ridge being permeable to water carries ths water in fractures of rock and — is axiomatic that all of the water that gets into the cracks, seams and openings that lead towards and into, and are within, the Snake Creek side, go- to Snake Creek and follows those channels and has done so from time immemorial.

NEPHI HUBER, a witness produced by the defendants at the former trial, and whose testimony was read into the record of the present trial, testified in substance as follows:

I live at Midway. My business is farming and stock raising. In connection with my brother, I own quite a tract of land, but only farm about 65 acres. We have water right for 65 acres and get out water from Snake Creek. I have been using water from Snake Creek about 20 years and was acquainted with the use of it before water was struck in the Mountain Lake tunnel and have been acquainted with it since that time.

Taking the ordinary season of precipitation, we have no more water now to use on our land than we had prior to the striking of water in the Mountain Lake tunnel. Considering the seasons fluctuate one year with another, some years higher and some lower, I would say that there is no more water now than there was before.

I am acquainted with the stream of water that flows down the canyon. I have crossed it just above Lavina Creek and at other crossings. I have noted a decrease. The last decrease was about two weeks ago compared with several years ago. I would
153 say there would be one-fourth as much water as the lowest I ever saw it before. This was in November, 1913. I do not think there was as much water there then as we generally get in our ordinary irrigating stream in Midway. We were short of water in the latter part of the season of 1913.

GOTTLIEB BUEHLER, a witness produced by the defendants at the former trial, and whose testimony was read into the record of the present trial, testified in substance as follows:

I have lived at Midway for 42 years. I am a farmer and own a farm of 60 acres. My source of water supply for irrigation is Snake Creek. I have been farming more or less all of the time I have lived at Midway and have personally irrigated land. I was acquainted with the water supply of Snake Creek during those years.

There is between ten and fourteen ditches from Snake Creek. Some of those ditches carry what we call two streams, that is, water for two people irrigating at the same time; in my judgment three or four.

I have been director of the company and have acted as sub-water

master. The water is generally divided according to shares. W use as a basis a share to the acre. I think I have received generall my proportion of that water according to my shares. During th last twenty years I have not had more than sufficient water for m use nor have my neighbors.

We have different classes of land to irrigate. One is a loam shallow soil and under that is pot rock, which is parous, and if yo do not have considerable water you cannot very well water it, it drie up very quickly. This pot rock is porous and absorbs water. Ther is a gravelly land that is hard to water and swallows up water quit fast and you must have a good stream to get over it, and once yo miss your turn, at the next turn it is so dry it is impossible to wate it. The black loamy soil is different; you can water that easier an it holds moisture, somewhat better than the other land. We hav some clay land, but not much.

I remember about the time the Mountain Lake tunnel struc water in 1901 or 1902. I had been using waters of Snake Cree before that time from 1872. After the striking of water i
154 the Snake Creek tunnel I did not notice any increase in th
general supply from Snake Creek.

I have noticed the flow of water in Snake Creek about opposit the portal of the Snake Creek tunnel in the winter time at the plac known there as the crossing. I think the flow of water down at th crossing was greater than the flow from the Mountain Lake an Snake Creek tunnels.

Cross-examination:

I think there was in the neighborhood of 3,852 shares of stoc issued to the incorporators of the Midway Irrigation Company whe the company was first incorporated.

There is something like 4,000 acres of land being irrigated i that section of the country that belongs to stockholders in the com-pany, and it is all water that is derived from water distributed b this company; in other words, there is no independent source o water in that section to speak of; there may be one or two littl ditches that don't amount to anything, but they would be insignifi-cant. Nobody gets any water except as he gets it from the irrigatio company, so that now the company is distributing to its stockholder and to others water for thirty-eight hundred and some odd acres.

I would judge there is a little increase in the quantity of wate from the portal of the Mountain Lake tunnel down to the crossin of Snake Creek, just above Lavina Creek.

When the snow is melting, pretty much [fll] of the water is use by the Midway Irrigation Company; all of the fifty or [sicty] secon feet. I have received more water than enough during high water, but that happens only occasionally. During the early part of the year we increase the size of our streams; we use all the ditch will hold.

Examination.

By the Court:

I plant alfalfa and wheat. We get our turn once in twenty days; sometimes oftener; from fifteen to twenty-two days. We have two hours to the share; sometimes less; sometimes an hour and a half.

Gottlieb Buehler recalled by defendants for further direct examination, testified in substance as follows:

In my judgment we have had less water since the year 1913, taking it as a whole, than before that time. It is my observa-
155 tion that our low water has come ealier, taking it through a series of years, than it came before 1913. That is a fixed and settled judgment that satisfies my mind.

We use more water per acre in the earlier part of the irrigation season than in the latter part and we need a bigger stream for our first irrigation than we do in the latter, or that is my experience. Other people use more water during the first irrigation than in the middle and latter part of the irrigation season. That is the general practice throughout the Midway irrigation season.

Cross-examination:

Prior to 1913 we usually got our low water along the latter part of July or the first of August. Since 1914 it comes along from the 4th to the 15th of July. It -s my judgment that indicates the change of the low water season prior to 1913 and subsequent to 1914.

John Clayborn, a witness produced by the defendants at the first trial, and whose testimony was read into the record of this trial, testified in substance as follows:

I have lived in Midway for over forty years. I own a farm and irrigate it from the waters of Snake Creek, and am acquainted with the supply of water for irrigation from the Midway system. I think there are from twelve to fourteen ditches and some of those have two streams; I mean that two men irrigate from them at the same time. These streams are divided according to the shares in the company. Each man would have an equal amount if he had an equal number of shares.

Q. I will ask you now from your experience as watermaster and as a farmer there, and your knowledge of the subject of the water of Snake Creek, whether or not the waters of Snake Creek, during normal flow, for many years last past, has been more than sufficient or sufficient to irrigate the land under that stream to be irrigated?

A. With economy and judicious use we had sufficient to water for many years, but nothing to spare.

Q. You had to use it with economy?

A. Yes, sir; we had to use it with economy, and we used it night and day as——

Q. I was going to ask you that in particular. When you say you used it night and day do you mean by that that you are up all night with the water.

156 A. Yes, I have been.

Q. Looked after it?

A. Looked after, each man looked after this water at night.

I was water master in 1901 and 1902. During the normal flow I distributed all of the waters of Snake Creek; they were all used and all needed. With economy and judicious use we had sufficient during the normal flow to irrigate land under that stream to be irrigated, but nothing to spare. It was used night and day. Each man looked after his own water at night. Before the Mountain Lake tunnel was constructed and they took the water (from the springs) we had sufficient by the people using it judiciously, just the same before as afterwards, some years might be more than others, but Snake Creek has been on an average, about the same year after year for the last thirty years.

The supply of water is ample when the snows are melting. In the early part of the season the flow is not uniform. It depends upon the weather altogether. During the high water flow we use the most water. We have to enconomize about the middle of July in order to have enough. The normal flow begins earlier some seasons than others.

If we do not have a certain amount of water we cannot put it over the ground. If we only have half of a supply it is practically of no use to us. You have to have a certain flow to get it on your land, especially lucern; you cannot do anything with a small amount of water.

I was not the sole victim of the shortage of water I spoke of in 1913; all of my neighbors were in the same fix as I. The stream was divided up on shares the same as before, but the streams were less. We had barely sufficient last year to farm our crops. The cause of the shortage in 1913 was because 11 second feet was turned down the creek into the river. In 1914 there was none turned down.

Cross-examination:

The waters of Snake Creek were practically all used for irrigation purposes some years before the organization of the Midway Irrigation Company. We do have heavy rain storms and the water rises for a day and then flows off again.

In 1905 we had a shortage. We were then getting all the water we were entitled to with the exception of the Ontario tunnel. The Ontario tunnel water was in excess of what we had theretofore been using.

157 We traded water in Pine Creek with the Ontario tunnel for five and one-half second feet of the Ontario water. The Pine Creek is water that formerly rose in those lakes, and flowed down the creek and reached our farm during part of the year, but it did not flow every season. It would dry up in August. We had a small stream from it in July, so that when we traded for the Ontario water we got a good deal more of a constant flow than we had before.

In 1905 we had the entire flow of Snake Creek, and in that year e had a shortage, and we might have had a similar kind of shortage r years before we traded for the Ontario tunnel water.

It was in the year 1895 that we traded for the Ontario tunnel ater. Since that time there has been some land put under irriga-on. I could not say how much, not a great deal.

Q. From my understanding of the situation, if you had all of the ater of Snake Creek at the present time without the Ontario tunnel ater there would be a very great shortage.

A. Yes, there would be a shortage.

I would say that I do not think the water has been appreciably in-reased since the Snake Creek tunnel was driven.

Witness (continuing): The irrigation company is distributing ater to people other than stockholders. There may be four hundred r so shares outside of the company; they were not share holders, still hey had a right to the water.

The company was organized with the intention that the total num-er of shares of the capital stock would be just the same as the num-er of acres to be irrigated, and the total number of stock now is, I elieve, nearly four thousand shares.

Exhibit 4 received in evidence.

Testimony of the witness, JOHN CLAYBORN given at the present rial was as follows:

I am the Clayborn who testified at the trial before. I have con-tinued to live at Midway since the former trial. I am a farmer and use water from the Midway Irrigation system and have been all of the time since the other trial.

According to my estimation we had less water in 1914 than the prior years. I believe 1914 was about average compared with the
previous years. 1916 compared favorably. 1917 was more
158 than an average flow compared with prior years. The pre-
cipitation in 1917 was a little more than ordinary but I have
seen snows just as deep and as heavy storms. We had high winds in the winter and it drifted the early snows into the ravines and we had more snows in the ravines and hollows than I have ever seen and that accounts for the fine flow of water we had in 1917. I be-lieve that for all of the years together up to 1918 the normal flow since 1913 has been somewhat less than the flow of the years pre-vious. I would not think it would be any more. Under the Mid-way Irrigation system we use a great deal more water for our first irrigation than for irrigation later on during the season. That is the general thing under the system.

Cross-examination:

The first year we issued tickets for the water was 1888. I have been water master several years but have lost my duplicate tickets. We do not keep the stubs any length of time; they are not required.

Those tickets were similar to the tickets issued in 1917. At the time stated, the man to whom the ticket was issued, was permitted to use the water and was required to comply with the directions on the tickets. Tickets are issued for both day and night, there is no difference made, some would water during the day and other men during the night so that water was used all day and all night; all the time. That was true from the time of the organization of the company down to the present. It was universal all over the system. If we did not use it in the night we would not have enough.

Redirect examination.

Where we had single ditches, we commenced at the foot of the ditch and issued each man his ticket according to his shares and when his ticket was exhausted and his shares were out, the man up the ditch took the water away from him and so on, but on the [doubl*t*]ditches we had to be more particular, that is where two men use two streams in one ditch. We would divide it in the center. One user would be a check on the other, that was the system.

Recross-examination:

Those ditches would be uniform as to quantity and the water according to the stock that was in the ditches; the water was divided according to stock; a ditch with two streams had just twice as much water.

159 The packing of the snow in the ravines in 1917 delayed the run-off about two weeks and the run-off is complete about the end of July or the first of August. From the time of the organization of the corporation down to and including 1912 the end of the run-off was usually from the first to the middle of July.

Robert B. Ross, a witness produced by the defendants, testified in substance as follows:

I am 61 years old. I have lived at Midway since 1872 but have been away a good portion of the time. I am a blacksmith, but a farmer when I am at home. I own a farm at Midway and irrigate it.

I would judge there is no great difference between the normal flow of Snake Creek in 1914, compared with the years previous to 1913; every year varies more or less. I noticed no difference in the normal flow in 1915 compared with seasons prior to 1913; 1916 was about the same. In 1917 I believe there was a little more than the average prior to 1913.

During the first irrigation period farming land requires more water than during the later irrigation period.

John U. Buehler, a witness produced by the defendants, testified in substance as follows:

I live at Midway. It has been my home since 1872. I have been away four or five years altogether in two different periods. I am 59 years old. I am a farmer and own my own farm of 80 acres.

In 1914 in my judgment, we had about the same as the average flow of water for the years prior to 1913. In my judgment 1915 and 1916 were about the same as in prior years. In 1917 the high water held out a little longer. High water generally falls about the 5th to 15th of July. In 1917 it held out until along about the 20th. During the various years prior to 1913 there was more water some years than in others. I think we had as much water in some years as we had in 1917.

Taking all of the years since 1913, and comparing the average normal flow during that period with the average normal flow of the years prior to 1913 I would say we had about the same amount
160 of water to my best judgment. I have not seen any material increase or decrease except in the year 1913 there was a little less, there was a certain amount of water turned down into the Provo river from Snake Creek and the users under the Midway Irrigation system did not use it during that time.

My experience is that it requires more water for the first irrigation than for those subsequent. I have noticed that fact from actual experience.

In 1895 we got five and one-half feet of water from tht drain tunnel and two and one-half feet of water was claimed by us and the Heber people. There was disputes in regard to it. The two and one-half feet was allotted to us by the Heber company at that time. Prior to that time we had disputes with the Wasatch Irrigation company and finally, at the time we got the drain tunnel water, the dispute between the Heber people and the Midway Irrigation Company was settled, so that we got two and one-half feet of water. We had used some of that two and one-half feet prior to that time, and we needed it to mature our crops. After securing that eight and one-half feet, we did not have more than sufficient water to irrigate our crops. After we got the water from the Ontario drain tunnel, the tunnel caved and our crops suffered because the water was cut off.

John E. Peterson, a witness produced by the defendant, at the former trial and whose testimony was read into the record of this trial, testified in substance as follows:

I have lived at Midway over 40 years. My occupation is farming. I have owned a farm of my own for 25 years and irrigated it. I am acquainted with the water supply of the Midway Irrigation system and have been during the years I speak of.

Q. In ordinary seasons, what we call normal seasons, does the water get from your thirty-five shares—is it more than sufficient to irrigate your thirty acres?

Mr. Nebeker: Let me make a suggestion to you at this time. We won't offer any proof on this line at all * * *. We do not make any contention on that. They need all the water. I think we can have that as a stipulation, and it will save, I take it, a great number of witnesses of this character * * *. I believe that

would be going as far as you would expect, that the other wi
161 nesses, whoever they are if put upon the stand, would testif
that they are stockholders; that they are in fact using th
water, and that they have needed the quantity of water furnishe
at all times to supply them for irrigation purposes.

Mr. Thurman: For [exonomic] use?

Mr. Nebeker: Yes.

Mr. Thurman: That is all we can prove, if your Honor please, o that question.

The Court: All right.

I remember using water as a farmer prior to the construction o the Mountain Lake tunnel and was acquainted with the supply fron Snake Creek at that time. I have been acquainted with the suppl since the Mountain Lake tunnel was constructed. There was n general increase in the flow of the waters in Snake Creek after th construction of this tunnel. We did not have more water than w had before. I did not notice any enlargement or increase in th flow of the stream. We do not have more water today in the norma season than we did prior to the construction of that tunnel, and tha covers as well the Snake Creek tunnel.

I have not been above the Snake Creek tunnel since it started I did know what they called the Marble Quarry Springs. I hav seen it when it flowed down by the crossing by the Mountain Lak road.

Cross-examination:

I saw the stream when I was working at the Mountain Lake, year ago. I have seen the stream at Midway, part of it every day. Whe I was working at the Mountain Lake I saw the stream once a week That was in 1901 and 1902 and after the Mountain Lake tunne struck water. After the first water came out of the Mountain Lak and went into the stream the stream might have increased a little bi but not for long.

The water which was being used to drive the compressor (at th Mountain Lake tunnel) came from springs. The day that wate was struck the compressor stopped running. Water came to th tunnel from a bog hole in the side. It was a bid stream; it would be three good irrigating streams. It call came out of the face o the tunnel in one stream. The springs that were dried up wer above the Mountain Lake tunnel.

162 Robert B. Ross, recalled by the defendants for further di-
rect examination, testified in substance as follows:

I wish to make an explanation, in stating the time that our low water commences, I did not mean that that was the lowest point that our water arrived at, because in August we have lower wate than in July, and I meant that was the time that our surface wate left us; the fore party of july.

Cross-examination:

The water decreases until January and February.

LOUIS HAAS, a witness produced by the defendants at the former trial and whose testimony was read into the record of the present trial, testified in substance as follows:

I live at Midway; am a farmer, have been farming 15 years at Midway and own 35 acres. For the first eleven years I farmed 112 acres.

I now get my water from Provo river ditch. Prior to four years ago I got it from Snake Creek. I farmed 112 acres from 1900 to 1911. I saw no increase in the flow of the waters of Snake Creek during 1902 and from then on down. Our supply of water below was not increased or enlarged during those years.

JAMES T. PYPER, a witness produced by the defendants at the former trial and whose testimony was read into the record of the present trial, testified in substance as follows:

I have lived at Midway [twent'-four] years. I have been farming twenty-three years. I got water from Snake Creek for about 15 years. There was no increase in the flow of the waters of Snake Creek used by myself and the other stockholders after water was struck in 1902 in the Mountain Lake tunnel. I did not notice any increase. If there had been a substantial increase so that I would have had more water on my farm from year to year, I think I would have noticed it. I generally used all the water I could get from my shares. I could have used more during the low part of the season with reasonable economy if I had had it.

163 FRANK WENTZ, recalled by the plaintiff for further cross examination testified in substance as follows:

On Exhibit 111 the measurements from 1901 down to and including the year 1913 are float measurements and from 1914 to 1918 inclusive are meter measurements and weir measurements. I have marked on Exhibit 111 the measurements which are float measurements and that explanation will carry through all of the other exhibits 1 to 11 to 114 inclusive.

Redirect examination:

The mean flow of the Provo river for 12 years on the 6th day of July from 1905 to 1916, both inclusive is 607 second feet. The mean flow is the average of the flow of the river added together and divided by 12. The actual flow of Provo river on the 6th day of July, 1907, was 2,040; something over three times the volume of the mean flow, 336 per cent. That is the date upon which we have a measurement of Snake Creek by Mr. Call of 136 cubic feet per second. If we assume the mean flow of Snake Creek at that time of the year to be between 40 and 45 cubic feet per second, then the

Call measurement of 136 and a fraction cubic feet per second would be practically comparable to the physical condition of the flow of Provo river on that date. The mean flow of Snake Creek as shown on Exhibit 111 prior to 1913 was 46.06 cubic feet per second.

CALEB TANNER, recalled by the defendants for further direct examination, testified in substance as follows:

The dividing line, or back bone of the ridge with reference to the south line of the Park City Special imposed in red upon Exhibit 47 is not anywhere near correct. It is not imposed on there correctly with reference to Clayton Peak. I have imposed upon the area within the red outline and designated as Park City Special the ridge as shown in and on the Park City Special on Exhibit 47 as a black dotted line. I have done the same with reference to the Cottonwood Special imposed on Exhibit 47.

Cross-examination:

Upon Exhibt 47 I have traced through the Cottonwood Special and the Park City Special in a dotted black line the divide information taken from those two special maps.

Redirect examination:

164 Exhibit 47 is a recognizance map and does not show the details in the accuracy that is contained on the two special maps, which are triangulation maps. Exhibit 47 is on a scale of five miles to the inch and the two special maps are on a scale of 2,000 feet to the inch, so that relative accuracy, other things being considered equal is in proportion to the scale of the map. Exhibit 47 is very largely sketched and based upon the topographic judgment of the engineeds; the others are very much more instrumental determinations, precise determinations.

Defendant rests.

The record shows that while Mr. O. N. Friendly, a witness produced by plaintiff in rebuttal was upon the stand, the following proceedings occurred:

Mr. Wedgwood: If your Honor please, I object to the introduction of any evidence on the part of the plaintiff under the allegations of the complaint and the answer and upon the course pursued by the plaintiff of resting without any evidence; no evidence is competent now upon the part of the plaintiff and it is improper for plaintiff to produce evidence upon its part. To do so would be merely to nullify his resting his case and permit him to become the plaintiff again and introduce evidence in support of his complaint after the defendant had put in its evidence, which in a certain sense and extent the plaintiff cannot properly rebut. Plaintiff's complaint alleges a certain state of facts. Certain of those facts

were admitted by the answer. Plaintiff rested its case upon the allegations of the complaint and the admissions in the answer, and having once rested his case upon the allegations in the complaint and the admissions in the answer, he now has no right to re-inforce or attempt to sustain by evidence any of the allegations of the complaint or to dispute any of the allegations of the answer.

The Court: The court is not called upon now, it seems to me to pass upon that question. The court would have been had you rested, but you have filed a counter-claim or cross complaint and there is a reply to the counter-claim and I have conceived as a result of the course of action of counsel in the case on either side that we are really now trying this case upon your counter-claim, and I shall proceed on that theory and overrule your objection.

Mr. Wedgwood: Will your Honor save us an exception?

The Court: Yes.

165 Mr. Wedgwood: Now permit me another objection. I object to the introduction of any evidence in this case on the part of the plaintiff, not waiving my prior objection, other than evidence pertaining to the appropriation and use of water of the Midway Irrigation Company and of the quantity of water to which it is entitled. Under any view of the case and under the suggestion made by your Honor, it seems to me that that is as far as the plaintiff is entitled to go. In other words, I object to any evidence whatever as to the history of the tunnel, conditions in the tunnel, water flow in the tunnel or geological conditions or their relations in any way whatever upon the flow of water from the tunnel.

The Court: As I recall the counter-claim it alleges not only your prior appropriations but also alleges the construction of this tunnel and the pretended claim, as alleged, of the plaintiff that it is entitled to the water flowing from the tunnel. As I recall the pleadings, that issue is made upon the counterclaim. Is that right?

Mr. MacMillan: That is right.

The Court: Unless you should make it a matter of pleading, as it appears that objection will be overruled.

Mr. Wedgwood: Will your Honor kindly save us an exception. Now, then, upon that statement I move an order be entered dismissing plaintiff's complaint.

The Court: I will take that motion under advisement, to be determined on the final disposition made of the case. It may be possible that that motion may be well taken, but it will be disposed of upon the final [*ussue*]; that is to say, the court may find on consideration that the plaintiff by resting would not be entitled to recover upon the complain-; in any event whatever rights the plaintiff has may be determined on the counterclaim, so that I will reserve a ruling on that at present.

Thereupon the plaintiff offered the following evidence in rebuttal:

Mr. MacMillan: I offer the evidence of Joseph R. Murdock, a witness produced by the plaintiff at the former trial.

At the beginning of the reading of the above testimony the following proceedings were had:

Mr. Wedgwood: May I make an objection to the testimony, if your Honor please. I further object to the introduction of any evidence on the part of the plaintiff in this case for the
166 reason that there is no allegation in the complaint that the plaintiff has any use whatever for this water either at the present time or in the future. It based its allegations in its prior complaint upon the fact that it had leased this water to the Provo Reservoir Company for the year 1914. The year 1914 has long since passed and as I say, there is no allegation in the complaint that they have any beneficial use for this water either by themselves or any licensee or lessee other than for power, and as to that, there is no question but that they have the use of it for power as it is used, and that allegation is not in the complaint.

The Court: Let me ask you Mr. MacMillan, what is the basis of your claim to the ownership of the water? Do you claim it by virtue of any appropriation under the statute of the State?

Mr. MacMillan: No, your Honor.

The Court: Do you claim it by virtue of development made upon your own land?

Mr. MacMillan: We claim it by virtue of the fact that it makes in a tunnel which is on our land and is, therefore, our water, and our allegations is that it was leased to be used for power purposes, also for irrigation, and was actually used during 1913 for irrigation, a portion of it turned down for one or two days in 1914 and then taken back, and after we had diverted it in 1915, by force of arms they took it away from us. When our complaint is amended that allegation will be put in the complaint.

The Court: I take it, taking the pleadings altogether, both the complaint and the counter-claim amount to an action on the part of each to quiet title.

Mr. MacMillan: That is exactly what it is.

The Court: The particular use that may have been made of it at any particular time is of no prime importance but as I understand the theory of your case, you are not claiming it by virtue of having made any appropriation of it pursuant to the statute of the State.

Mr. MacMillan: No, your Honor.

The Court: You expect to prove you own the land upon which the tunnel is.

Mr. MacMillan: That is admitted already by answer.

The Court: And that by virtue of the ownership of the land you have the right to the water that rises on it?

167 Mr. MacMillan: Yes, your Honor.

The Court: Without any appropriation?

Mr. MacMillan: Without any appropriation.

Mr. Wedgwood: I don't want *it* (this) to pass without some observation. I have not given the court fully my idea I think as much as I am properly bound to at the present time.

The Court: We will not stop to discuss it now. The objection may be overruled.

Mr. Wedgwood: Save an exception.

The Court: The matter will be finally passed upon in the determination of the case.

JOSEPH R. MURDOCK, a witness produced by the plaintiff at the former trial and whose testimony was read into the record of this trial, testified in substance as follows:

I live at Heber City, about four miles East of Midway. I have resided there about ten years. Before that time I resided at Charleston about four miles south of Midway for nearly forty years. I am 56 years old.

I am interested in taking water from Provo river for irrigation purposes below Snake Creek in connection with Provo Reservoir and Utah Lake Irrigation Companies. The Utah Lake Company have an interest in several reservoirs at the head waters of Provo river, probably thirty or forty miles northeasterly from Midway. They were begun about four years ago. The waters of the reservoirs are used for irrigation.

I am acquainted with Snake Creek and I know where Lavina Creek is and of the two streams flowing together, that is about three miles up the canyon northwest from the town of Midway. Mr. Brooks made measurements of the waters of Snake Creek and Lavina Creek. They were made 200 or 300 feet below the place where Lavina Creek and Snake Creek flow together. It was in the year 1898 we sufficiently finished a weir to make a fairly good estimate of the flow in the early part of the season and later as the water receded we placed more plank across the stream and got a fairly good estimate or measurement of the flow in the low water [period]. The dam was built by the felling of a small tree across the stream and placing other timbers in below that cross-wise
168 and lengthwise to hold the rock and brush that were placed in the stream and then we placed on top of this a weir of board and plank with two pieces so as to force the water through the opening as outlined in the book of instructions we had.

In 1900 when Mr. Brooks made the measurement, the dam was there intact. The gravel had washed down until the stream above the dam was about level with the weir boards we had placed in the year before. I took Mr. Brooks up and back from my home in Charleston every morning and at this instance took up more timber to raise the weir board. It was running nearly the full width of the weir board when we got there and we contracted it so as to bring it within the space that Mr. Brooks desired. We had been working on the dam, stopping all of the leaks so as to flow all the water over the weir board. After this work was done the dam certainly did hold all of the water. There was not any flow of consequence in my judgment underneath the dam. If Mr. Van Wagenen had anything to do with the making of this measuring station I have no recollection of it or of Mr. Kohler either. I am referring to the weir that was made in 1900.

Mr. Van Wagenen assisted in making the weir in 1898 and probably in 1899. We were there some three years. I haven't any recollection of he or Mr. Kohler doing anything in connection with that dam in 1900.

I saw Mr. Brooks make the measurement. I have no recollection of Mr. Van Wagenen being there. I could not give any details of Mr. Brooks' measurement.

Captain Springer made some measurements at my request. My recollection is that it was in 1908 but I am not certain. They were mare nearly a mile and half below where Lavina Creek and Snake Creek come together. A weir was constructed for the purpose of making measurements on the same general lines as the one above was constructed by Bishop Probst. I remember of being at this weir but once. I casually examined it. To the best of my recollection there was no water flowing down the stream except such as went over the crest of the weir. He reported his whole measurements to me on a little note book. Exhibit 32 is the report Captain Springer handed to me.

I had an arrangement with the Snake Creek Tunnel Company to use the water in 1911. In 1912 I believe we did the same; I refer to the Provo Reservoir Company. I could not say in regard to the number of second feet nor how long we had water in 1911, but it was during low water.

169 I cannot remember the number of second feet we had in 1912, but after the high waters had receded we received from the Snake Creek tunnel two-thirds of the water developed in the tunnel, minus some percentage for loss in transmission until the 28th of July. After that we received for use through our system, all of the waters of the Snake Creek Tunnel Company except that part which the commissioner deducted for seepage. The commissioner was Mr. Barzee. In 1912 we received water equal to the amount of water flowing in Snake Creek tunnel from two sources; partially from the Midway upper canal where they were taking water they acquired by purchase from the Ontario Company. We took about four second feet of that up to July 28th. We obtained one and a fraction second feet from Snake Creek proper. Thereafter we received the whole flow of the tunnel except the amount the commissioner deducted as loss by seepage and evaporation. I do not remember the amount exactly but approximately seven or eight second feet. We received it from the Midway upper dam and from the main Snake Creek channel. There was no part of the season 1912 that we did not use that water when we needed it; during the low water period.

In the year 1914 we received water from the Mountain Lake tunnel during all the low water period of the year, except there might have been an occasional interruption of a day or half a day. We received three and one-half to five second feet from the Snake Creek channel proper and from the main channel of the Provo river. We received water from sometime in July until September.

I have been acquainted with Snake Creek since about 1898. I have seen it almost every year since during the low water period and before and since the Snake Creek tunnel and Mountain Lake

unnel were constructed. I have observed in a general way the uantity which flowed in the streams. The flow of the water in the tream has continually increased since the construction of the tunnel.

Cross-examination:

I am engaged in the business of farming, merchandising, banking, irrigation promotion, stock. I am connected with the Heber Mercantile Company, as large an institution as there is in that section of the country and I have been connected with it about eight years. I am President of the company. I devote a few hours a week o that business. I have been President of the Bank about six years nd devote a few hours a week to that. I own a farm near Heber City of about 160 acres. I give it attention only indirectly.
170 I have been in the stock business about nine years. I own
about 1,400 head of ewes. I give them some attention but I don't direct the operations of the herd. I talk to the manager who ents from me. Besides that I have the business of irrigation. I am lightly interested in the Utah Oil Refining Company at Salt Lake City and attend its board meetings. I have visited Salt Lake City about once a week for the last five years. I spend nearly half of my time in Provo and Salt Lake and that was true as to the years 1911, 1912, 1913 and 1914. When in the vicinity of Heber I have these various business affairs to keep track of to a certain extent and [attend] meetings of the board of directors every so often.

In 1914 I was at Midway almost every week during the low water period. I usually took an automobile trip over to Midway; up the river to the Wasatch dam; back down the river to Charleston and back up to Midway again. I was there usually every week; sometimes every two weeks. I kept no memoranda of the times I was there. I will say I was at Midway about the middle of July, 1914. I cannot give detailed information of any particular trip. I cannot give the dates that I was there in August. I was there sometime in August, I do not remember when. I was there in September; I cannot remember the date. I went to the Midway upper dam and the Midway lower dawn and went down to Snake Creek and took in the water distribution all along on that side of the river. I am not positive as to the two trips in July, one in August and one in September was all the trips I made. My recollection would be that I made frequent visits to all of the points of diversion during the low water period from sometime in July until the close of the season in 1913.

I do not remember of being with the board of directors of the Midway Company or any of them on Snake Creek in 1913. I remember the water was turned down below the lowest point of diversion of the Midway Company in 1913, but I cannot remember whether it was in June, July, August or September. I know it was before August. I cannot tell how many times I was there in August nor as to any particular date. I could not say as to the number of times I was there in September 1913. I hardly think I was there in June

1912. I am not positive. I might have been there the first of July and might have been there the 12th of June. I was there in July, I would not say the number of times, I cannot remember. I cannot remember just what was done on those particular dates and I hardly think I was there in June 1911. I am not certain whether
171 I was there in July or in August or in September. I am
certain I was there in 1911 but not certain I was there more than once. I am a pretty busy man, I leave some for the other fellow to keep track of. On those various trips I was up Snake Creek as far as the power company's dam once. I think I have made other trips up above the lowest point of diversion of the Midway Irrigation Company. I made one trip with the water master of Midway and some of the directors in one of the years I am talking about up to Huber's flat, about half way up, I cannot remember which year it was. I do not care to commit myself further than to say that it was during those four years.

I am President of the Provo Reservoir Company. I am acquainted with two or three of the officers of the Mountain Lake Mining Company. I knew of the litigation between the Mountain Lake Mining Company and the Midway Irrigation Company; I was a witness in the case. At the time of that trial I knew Captain Springer; I have been acquainted with him for years and knew all I know now about Captain Springer's measurements. I might have testified to them; I do not remember whether I did or not. After the decision of that case by the lower court I became interested in the water from the tunnel. That interest materialized soon after the decision in favor of the Mountain Lake Company by the lower court. We leased water from the company; not a perpetual lease, one year at a time. I do not know whether there is anything further than correspondence asking for it and the letter conceding it. No formal lease was given. I cannot say whether any water flowed down Snake Creek in the low water season at any time prior to the final decision of the lower court in the case referred to, below the lower point of diversion of the Midway people. I am under the impression that we got some before the final decision was signed, but I am not certain as to that, that is only my impression.

I have no personal knowledge of water flowing down the natural channel of Snake Creek past the lowest point of diversion of the Midway Irrigation Company into Provo river in 1914. After the decision of the lower court in the Mountain Lake case I made a demand that water be turned down to us. I do not remember how much I claimed. I think the amount asked for on that first occasion was three second feet.

As a fact, in 1898, Mr. Van Wagenen and I were associated together in developing a power plant—actually working together. He and I built the foundation of the dam I spoke of and worked along together about two years; that would bring it up to
172 the time of Mr. Brook's measurements. I do not remember
Mr. Van Wagenen taking any part in the surveys that we were making and the repairing of this dam. The work was actually done by the men who went up there to meet the requirements, and

he may have come in there, but he was not a regular employee, nor working as I was, and the other men, on that occasion; he might have went past. I could not say but what he might have been there. I do not remember how many measurements Mr. Brooks made there.

In general, my custom in making the trips about which I was cross-examined—we went primarily to take the measurements of the streams that was supplying us with water. Customarily and usually to this Snake Creek dam, when there was water flowing in that; that is the last diversion on the Snake Creek to the Midway Lower Dam on Provo River, which is situated between the last one, where the last dam that the Midway had on Provo River was between Heber and Midway; we would go there almost invariably to see if that was right at this particular dam, and then to the dam at our intake. If we found anything wrong we called upon the Water Commissioner of the County or the Court Commissioner or to——

Q. Does this point include all points of diversion of the Midway Company?

A. Yes, sir.

Witness, continuing: In 1912, 1913 and 1914 we made those visits on an average from three to six times a month.

Speaking about the year 1912—water from the Mountain Lake tunnel and Snake Creek tunnel. The attorneys for the company we leased the water from threatened contempt proceedings against the Midway people if they did not turn that water down. The water was turned down back and forth at different times in different quantities. It was not regular, even in 1913. I do not know whether or not the threatened contempt proceedings were after the motion for a new trial was overruled and the judgment became final.

O. N. Friendly, a witness produced by the plaintiff on rebuttal, testified in substance as follows:

I drew the diagram marked Exhibit 121. It shows the general arrangement of the stream flows in the canyon, also the location of the various weirs. It is not drawn to scale. Starting from the Mountain Lake tunnel weir on the left and running down Snake
173 Creek channel to a point where Snake Creek channel leaves
for Provo river, and showing generally between those two points the approximate location of various objects in connection with these creeks that have been testified to by the witnesses. The power pipe lines and the various pipe lines are in pink; the main streams and ditches are in blue. North is towards the top of the map. The arrows show the direction in which the flow runs. On the up-er left hand side is the Mountain Lake tunnel weir at the portal of the tunnel. From there it is about two miles down where the Snake Creek tunnel water flows into the stream. Just above that point is where the Snake Creek tunnel road crossing is, where all the meter measurements were taken. The Snake Creek tunnel weir is located at the portal of the tunnel. The power company's intake is just under the junction of the two streams, where they have a diversion

pipe over to their main intake. The power company's intake is indicated on the main Snake Creek channel by a square which is marked "power intake" and tinted in pink. The pipe line goes from that intake over to a similar power intake constructed in Lavina Creek and indicated by an arrow marked "Lavina Creek weir." The spillway runs down the old channel and joins on to the spillway from the first intake in the main channel. From there the water runs down the old channel past the power house. Before the two power intakes were placed there Lavina Creek would pass down what is marked "Lavina Creek" th-ough the point marked "power intake" and through the portion marked "spillway," and the Snake Creek tunnel would flow down the portion marked "Main Snake Creek channel" past the point [ma*t*ked] "power intake," through the point marked "spillway" to the point where the two spillways join each other and that would be the point which has been referred to in the evidence as the confluence of those two streams. From there down the canyon the water flows in the one stream known as the Snake Creek channel. Just above the power house the Springer spring overflow enters the main channel, located between the power pipe line and the old Snake Creek channel marked "Springer Springs." From this spring runs the upper Huber ditch, so marked. The lower end is marked "Current Meter Data," being the point where that ditch was measured. The ditch runs beyond that point. Also above the power plant is shown the West Bench ditch and Probst ditch, on the old Snake Creek channel. Those are fed from the Springer Spring, the pipe line overflow and the west Bench ditch, in addition some from the tail race of the power plant.

174 Following the West Bench ditch out to the right we come to the Gerber spring which also feeds the West Bench ditch as well as the Midway pipe line which furnished water to the town of Midway. This spring is marked by a hatched rectangle marked "Gerber Spring." The Midway pipe line is indicated by the red portion leading out to the right from there and so marked.

The Probst ditch is the lowest line on the map bearing to the right and is marked "Probst Ditch" with an arrow. It is one of the irrigating ditches through which water is diverted from this stream. The point marked "current meter data" with an arrow indicates the point where measurements have been taken. The lower Huber ditch turns off from the main channel immediately below the power plant, and is so indicated and the current meter data was also taken from that ditch very near the junction, at the point indicated by the arrow. Going down the main channel we come to Mahogony springs, indicated by a hatched rectangle. From this spring the Wilson ditch leads off to the left and the Scotch ditch to the right. Both are connected and there is also a spillway leading back to the main channel, unmarked, but represented by the blue portion running from the part marked Mahogony springs down to the connection with the main Snake Creek channel. The points are indicated on Wilson ditch and Scotch ditch where the current meter measurements were taken. There is also a point indicated at the extreme right of the

map where the current meter measurements were taken in the main Snake Creek channel; it would be immediately below the mouth of the canyon. These are all ditches of the defendant company for the purpose of diverting water into their irrigation system.

The White Pine system is an independent canyon and feeds an independent ditch known as White Pine ditch and shown at the top right hand part of the map. The place where the current meter measurements were made is indicated by the arrow with the words "current meter data."

CORDELIUS A. SPRINGER, a witness produced by the plaintiff on rebuttal, testified in substance as follows:

I am the Cordelius A. Springer that testified in the former trial of this case before Judge Pope. A considerable portion of my examination related to the whereabouts of some of the original notes I made of meeasurements I testified to. I testified I took some measurements and placed them in a book at the time I made them
175 and that other measurements were taken and placed on a piece of paper and then copied into the book.

Since the former trial I have made a search to discover whether I had those original [eentried.] I have not been able to find them. I went through the desk where I keep all of the old papers and examined all the papers in the desk. I haven't possession of those papers.

Whereupon the testimony of Cordelius A. Springer at the former trial of this case was offered and read into the record in substance as follows:

I reside in Snake Creek canyon, about three miles west of Midway, about twenty yards from the channel of Snake Creek and about two miles below the point where Snake Creek and Lavina Creek come together.

I have followed stock raising and farming for the last thirty years. I am acquainted with the Snake Creek drainage area and with the streams there. Between my place and the head of the canyon Springer springs, Lavina Creek and several other small springs flow into Snake Creek.

I am acquainted with Garibou Creek and the Marble Springs. Springer spring is located about 1,000 yards in a northerly direction from where I live. These waters are used for irrigation purposes by the Midway Irrigation Company. I use waters from it for irrigation and culinary purposes; some years all of it and other years none of it. The creek often changes there and we cannot get it across the creek. We formerly had it flumed across the creek and used it in the Fox ditch.

I have been familiar with Lavina Creek for thirty years. I saw it four or five times in 1914. I did not observe its flow particularly during that year. I did not notice any difference in its flow in 1914, as compared with previous years. I do not know of any springs on Lavina Creek that have ceased to flow in recent years.

Carbou Creek does not run the whole year. It has never done

so during the time I have been there. Sometime in the latter part of July or the first of August it will go dry. Up to that time its waters flow right into the Snake Creek channel. I never saw water flow down that channel only in high water. I did not see the stream in 1914 or in 1913. It is a very small stream which flows from the Marble Quarry Spring. There are times when you
176 have to dig for water very late in the fall. Several times I have camped there late in the fall when I had to dig for water. I know when the Mountain Lake and the Snake Creek tunnels were driven. Prior to that time I had to sink in order to find any water in Marble Spring. I know there are great many tunnels driven in the north side of the canyon in which has been referred to as the Snake Creek drainage area. I have seen the most of them; possibly ten or twelve.

Following are the tunnels in that country which I am familiar with: Balsam Grove, Iron King, Southern Tier, Hamilton, Blue Bird, Wolverton, Revelator, Wide West, Hacket, American Boy, Rochester, Iron King, Bee Hive, Monenal Myrle.

None of the tunnels I have seen flow water; no water flowing in any of them, only in some that I dug myself at the head of the canyon. I did not take that into consideration. To the best of my recollection all the water I ever saw flowing from any of the tunnels mentioned was from the Tantamount. This was a very small stream. But I have not been in that for the last six years. A very small stream of water was flowing from it at all times of the year when I was working there.

During the thirty years I have resided upon Snake Creek I have observed the size of the stream. I observed it prior to the time the Mountain Lake and the Snake Creek tunnels were constructed. I observed a difference in the quantity of water flowing in that stream since the driving of these tunnels as compared with what the flow was prior thereto. The flow has increased quite considerable.

In 1907 and 1908 I assisted Mr. Call along in August in making measurements. We made measurements of Lavina Creek, Snake Creek, Springer Springs, Gerber Springs and Mahogony Spring.

The weir in Snake Creek where I made measurements is located about half way between the power plant and where I reside. The stream at that point contains the waters of Snake Creek and Lavina Creek, Springer Spring and all other springs above that point. Mr. Jacob Probst placed a weir in the stream where I made the measurements I took readings of the depth of water flowing over the weir for Mr. J. R. Murdock. I made notes of the readings I took at the time. I took the readings of the *guage* we had setting approximately 50 feet up the stream from the weir. I made a note
177 of the date when I took the readings. I gave those notes to Mr. J. R. Murdock.

Exhibit 32 comprises the notes I made. Pages 5 and 9 of Exhibit 32 are in my own handwriting. The weir was 10 feet 1 inch wide. The depth of the water flowing where I took the measurements was: December 26, 1907, 5-7/8 inches; January 1st, 1908, 5-3/4 inches; January 2nd, 5-3/4 inches; January 3rd, 8 a. m.

5-5/8 inches; 4 p. m. 5-3/4 inches; January 4th, 5 p. m. 5-5/8 inches; January 5th, 8 a. m. 5-5/8 inches, 5 p. m. 5-3/4 inches; January 6th, 8 a. m. 5-1/2 inches; 5 p. m. 5-5/8 inches; January 7th, 8 a. m. 5-1/2 inches; 5 p. m. 5-1/2 inches; January 8th, 9 a. m. 5-5/8 inches; January 9th, 3 p. m. 5-5/8 inches; January 10th, 8 a. m. 5-5/8 inches; January 11th, 9 a. m. 5-5/8 inches; January 12th, noon, 5-5/8 inches; January 13th, noon, 5-5/8 inches; January 15th, 9 a. m. 5-1/2 inches; January 16th, 9 a. m. 5-1/2 inches; January 17th, 4 p. m. 5-1/2 inches; January 18th, 4 p. m. 5-3/8 inches; January 19th, 5 p. m. 5-1/2 inches; January 20th, 10 a. m. 5-3/8 inches; January 21st, 10 a. m. 5-3/8 inches; January 22nd, 4 p. m. 5-3/8 inches; January 23rd, 10 a. m. 5-1/2 inches; January 25th, 11 a. m. 5-3/8 inches; January 27th, 10 a. m. 5-1/4 inches; January 28th, 11 a. m. 5-3/8 inches; January 29th, 10 a. m. 5-1/4 inches; January 31st, 9 a. m. 4-3/4 inches; February 1st, 10 a. m. 4-7/8 inches; February 2nd, 10 a. m. 5-1/8 inches; February 3rd, 9 a. m. 5-1/4 inches; February 4th, 2 p. m. 5 inches; February 5th, 3 p. m. 5-1/8 inches; February 7th, 5 p. m. 5-1/4 inches; February 9th, 11 a. m. 5-1/4 inches; February 13th, 3 p. m. 5-1/4 inches; February 16th, 9 a. m. 5 inches; February 20th, 3 p. m. 5 inches; February 22nd, 11 a. m. 5 inches; February 24th, 9 a. m. 5 inches; February 27th, noon, 5 inches; March 1st, 9 a. m. 5 inches; March 7th, 10 a. m. 4-5/8 inches; March 10th, 10 a. m. 4-3/4 inches; March 13th, 4 p. m. 4-5/8 inches; March 15th, 3 p. m. 4-3/8 inches; March 18th, 10 a. m. 4-5/8 inches; March 22nd, noon, 4-5/8 inches; March 25th, 8 a. m. 4-5/8 inches; March 28th, 4 p. m. 4-5/8 inches; March 31st, 9 a. m. 4-5/8 inches; April 3rd, 9 a. m. 4-3/4 inches; April 7th, 11 a. m. 4-3/4 inches and April 10th, 4 p. m. 4-7/8 inches.

I have never noticed any diminution in the flow of Springer spring.

178 Cross-examination:

Springer spring is a very small stream.

Before the Mountain Lake tunnel was constructed there were springs that run throughout the year below the tunnel above Lavina Creek; the Dugway Springs and what we use to call the Balsam Spring and the spring that came down from the Marble Quarry. Marble Spring is not exactly the same as the Marble Quarry spring. There are other little springs coming out of that little gulch that make what we call the Marble Quarry springs, where it comes into Snake Creek. That is one of the perennial springs that flowed in. I have never seen it dry. I did not see it dry last year. It might have been dry last year for all I know. I have not seen any of these little springs I have mentioned above Lavina Creek and up to the Mountain Lake tunnel for the last six years. I know the Dugway spring was flowing last year.

I have not seen the Tantamount tunnel for the last six years. I cannot say that the two tunnels, running water prior to last year, referred to by Mr. Alder did not dry up last year.

Redirect examination:

The portals of the two tunnels I spoke of that I saw some six years ago where some water was flowing are very close to the bed of Snake Creek, just above the level of Snake Creek.

CORDELIUS A. SPRINGER recalled for further cross-examination testified in substance as follows:

The general rule is that the snow commences to melt in March and along the first of April the streams are likely to carry more water than in February, so that the information I got there from these measurements must have shown an exceptional condition.

I was a witness in the Mountain Lake case. I did not testify as to those measurements in that case.

CORDELIUS A. SPRINGER, recalled for further direct examination at the present trial, testified in substance as follows:

I stated in my evidence at the former trial that I assisted Mr. Call in making some measuremests of these streams and springs. They were made by cleaning out the creek in the straightest place we could find by dropping a stick measure for a distance of the depth of water across in several places and then taking a willow
179 stick and throwing it into the stream as near the center as possible and taking the time by a watch that it took the stick to float this distance that was measured off.

We were unable to find any place where the streams would be straight like a flume, but we got the straightest place we could find.

By way of clearing out the stream we got into it; shoveled out the bottom of the stream, all the big boulders the best we could and cleared the bank from brush and willows. After we had done that the surface of the stream was rough. Before we dropped our float into the stream Mr. Call measured the length of the place we should float the stick and also made about three measurements of the depth of the place at different places across the stream.

After that I would go up the stream where he had measured it off and he would go down to the end of it and I would drop the stick as near the center of the stream as I could and see the time when I let go of the stick. Ordinarily we stood apart probably from six to ten feet. He had an ordinary watch with which to time the float. He would drop the stick in the one place on the stream several times. By that method I assisted in measuring Springer springs, Snake Creek, Lavina Creek, Mahogony Springs and Gerber springs.

Lavina Creek is not ordinarily a stream of uniform depth. It has a very rough bottom and is crooked and brushy on the sides. It is deeper in some places than it is in others. I do not know of any difference between these streams which we measured and the usual mountain streams.

I first started using the waters of Springer springs about 1883.

Q. I will ask you whether or not at any time since 1883 any officer or person connected with the Midway Irrigation Company has ever visited you and talked to you with regard to the use of the waters of Springer springs.

Mr. Wedgewood: I object to it as immaterial. I do not see what bearing it has on the case * * * An officer whoever he might be would not have power to bind the company unless he is specially delegated.

The Court: If it was some officer that had charge of the distribution of water I think it would be competent.

Mr. McMillan: I cannot bring that out with Captain Springer.

180 The Court: If you will promise to do that. Anybody might make a complaint you know.

Mr. McMillan: I shall promise to show——

The Court: Connect it up with the company?

Mr. MacMillan: Absolutely.

Mr. Wedgewood: I save an exception.

The Witness: Since 1884 persons connected with the Midway Irrigation Company have come to me and talked to me about using those waters. The first one was Theophalis Robey. The next was John Buehler. The next Charles Bronson and the next Fred Hauter. I do not recall any others. They said they were burning up in Midway. They said nothing about Springer spring. It was the creek waters I was using; not the spring waters. They said they needed all the water in Midway and that I had no right to use it. They came to me several years, I cannot recollect how many. It was before 1895. I cannot recollect whether they came after that.

Cross-examination:

I have a small garden, probably half an acre. I do not consider that half acre within the Midway Irrigation Company. I asked the Midway Irrigation Company to take care of that in Provo river suit, so I considered myself within the Midway Company to that extent. I have used a portion of Springer Spring each year for irrigating that half *half* acre. Nobody has bothered me in using it since 1895 that I remember of. Before that when I was using the waters of Snake Creek I considered that I had a right to use it and they considered that I had no right I am not a stockholder in the company.

W. D. Bogan, a witness produced by the plaintiff at the former trial and whose testimony was read into the record of this trial, testified in substance as follows:

I went into Snake Creek about in 1884, prospecting, right at the head of the canyon. I run a couple of tunnels into the mountain, about 300 feet in the two tunnels, at a point in round numbers about

500 or 600 feet above the Mountain Lake tunnel at about the same elevation. I found no water in those tunnels that did not run out right away; it did not stay there at all. There might be a little pocket of water in the lower tunnel when we cut that and
181 when it run out there was no water there. That was prior to the time the Mountain Lake tunnel was built.

I am now living down the canyon perhaps a couple of miles below the tunnel in Caribou gulch. I have been prespecting and mining there for seventeen years. I have done something like 3,000 feet of work. I do not know what the altitude of my work might be above the portal of the Snake Creek tunnel. The grade of the canyon in portions is quite steep and in others not so steep. I would think that would be 800 feet above the portal anyway. In my workings in the Caribou gulch I have handled a little water in some of my tunnels there. There was not sufficient to run out of the tunnel at any time. I got water for my own use from the spring about 600 feet up the gulch, above the cabin I built there. We had it piped down these last few years in a half inch pipe. This summer the pipe has carried all of the waters supplied by the spring. I have never noticed any change in the quantity of flow of the water in that spring. It was still flowing about as usual when we quit in December.

Referring to Exhibit 24, I was working on the Oregon claim. That is the Bogan group according to this map. The heavy lines surrounding the Bogan group indicate the boundaries of the patented claims owned by me. The Oregon is the one on which I have been at work. I think my cabin would be located at about a point where the letter "O" is. I would say it was about a mile from my cabin down to the portal of the Snake Creek tunnel. I traveled back and forth over the road past the tunnels frequently. I have observed the flow of water in Snake Creek in former years and in the present years. I have not observed it so much these last few years only where I cross it at the Snake Creek tunnel. I have observed it where all of the water of the creek is flowing in the creek down near Midway. I have noticed a change in the volume of water flowing in the creek this winter in reference to former years. It seems to me a great increase. Where I cross the creek above Snake Creek tunnel during recent years the flow generally looked pretty much the same. There might have been some difference in it, I did not notice it.

There is not a continuing flow of water down Caribou gulch. It generally commences to flow to the canyon along the fore part of May and in the latter part of July I believe it ceases to flow by my cabin. In 1914 it did not run by my cabin after July 23rd.

182 Cross-examination:

I believe the Bogan group of claims was located in 1897. I bought the Olympia and Oregon claims. They were located before I went there.

There is some land that does not seem to be occupied by claims.

The Rochester I own; it is not patented. I am fairly well acquainted with the flow of Snake Creek from my place down to the tunnel and down to Midway. I have not been up in the canyon for a good many years so I do not know anything about the waters of Snake Creek above my place. My cabin was right in the Caribou gulch. Snake Creek is always the highest about June and the lowest in the fall and winter. I do not know when it gets the lowest, I generally left there in the latter part of December.

At the crossing above the Snake Creek tunnel I never noticed any particular increase in the stream. It generally runs about the same each year so far as I have observed as I go along. My testimony is given just by general observation.

The first I noticed the flow down below the Snake Creek tunnel particularly was on the 5th day of December. I looked at it on the 25th again and it looked a little larger, but I do not know whether it was or not. I have not seen it since. I did not make any observations specially to see whether there was any increase or decrease.

Frank Deming a witness produced by the plaintiff at the former trial and whose testimony was read into the record of the present trial, testified in substance as follows:

I am a civil engineer. I was court commissioner in connection with the distribution of water in Utah County and appointed by Judge Morgan of the Fourth District Court in 1914. In a general way my jurisdiction was of the waters of Provo river and including the waters of Snake Creek. Mr. P. F. Wentz and George Taylor were deputy commissioners.

I had to do with the actual distribution of the waters of Snake Creek as between the Provo Reservoir Company and the Midway Irrigation Company in 1914. The first occasion was on August 6th and 7th. I was at various places for the purpose of making observations of the stream for the purpose of determining whether the Provo Reservoir Company was obtaining an equivalent amount of water of that flow from the Mountain Lake tunnel. Observations were made at the weir near the County Road in Snake Creek
183 below Midway above the junction of Snake Creek with the
Provo river and below all of the points of diversion of the Midway Irrigation Company. There was water flowing past that dam through Snake Creek. I estimated the quantity at about two and one-half second feet. I made an investigation at that time to ascertain whether the Provo Reservoir Company was receiving water from the Provo river supply of the Midway Irrigation Company and they were receiving approximately two and one-half second feet, making a total of four and one-half or five second feet.

In the year 1914, about August 18th or 19th, a dispute arose between the Provo Reservoir Company and the Midway Irrigation Company that was brought to my attention. I called on the water master and President of the Midway Company and had one conversation with both of them. I made observations to determine whether there was any water coming down Snake Creek at that time. There

was very little. I then took the matter up with Mr. Bronson th water master. I ordered him to turn the water down and he said h did not have authority. The following morning I saw Mr. Va Wagenen, the President, and I asked him why the water was no being turned down. He asked permission from me to allow a po tion of that water to flow down Snake Creek and a portion to b taken from the Provo river supply. I replied that I had no au thority to make any such arrangements. I told him the wate would have to be turned down and he said it would be if I woul give him time to make the distribution. I got the water that day.

Q. Was any water distributed by you or under your direction t the Provo Reservoir Company on account of the Mountain Lak tunnel water in 1914?

Mr. Thurman: We object to that for the reason that water tha may have been delivered to him on that account is not material The question is whether it was taken from the Midway Irrigatio Company, not some of the waters in the river distributed on accoun of something, but was the water company deprived of it.

The Court: That can be developed in the answer.

Mr. Thurman: Please save an exception.

A. They were never given less water than the total quantity tha was turned into the river stream, including the waters of the Moun tain Lake tunnel.

184 The Witness: I made a measurement of the flow of th Mountain Lake tunnel water on August 8th, 9th and 10th 1911, at the portal of the tunnel and at a point near the Buehle Switch by means of weirs. The quantity of water flowing at tha time from the portal of the tunnel was; August 8th, 3 p. m. 8.45 sec ond feet; August 9th, 7 a. m. same quantity; August 9th, 6 p. m same quantity and August 10th, 7 a. m. same quantity.

I made a measurement of the flow of the Mountain Lake tunne waters on August 6th and September 2nd, 1914, at the same point where these measurements were made in 1911, by means of the same weirs. There was flowing at the portal of the tunnel on August 6th, 9.2 second feet; September 2n-, 7.30 second feet.

H. L. Stoner, a witness produced by the plaintiff on rebuttal, testified in substance as follows:

I am a hydraulic [enginner]. I have charge of all of the work upon the entire system of the Utah Light & Power Company in the states of Utah and Idaho, and have had charge of that work since March, 1912. The business of the Utah Light & Power Company is the generating and sale of electric current generated by water power. From June, 1911, to November, 1913, I was in the employ of the Water Resource Branch of the U. S. Geological Survey, serv ing in Utah and Idaho. My duties embraced that of a hydrog rapher engaged in stream measurement work. I am familiar with Snake Creek and Snake Creek drainage area. My first trip there was in April, 1913. I have personally made measurements of the

flow of water in the streams in that district. One of the plants of Utah Power & Light Company is located on Snake Creek above Midway. The record obtained of the flow from the streams of Snake Creek fall under my jurisdiction. All measurements I have made of mountain streams have been with current meter or weir; mainly by current meter.

I know the method of ascertaining the flow of the water of natural streams known as the maximum surface velocity method, in which the velocity is obtained by using a float in the fastest part of the stream channel, and to use this velocity multiply it by .8 for the true velocity. To get the cubic feet per second flow in the streams it is necessary to know the velocity, the average velocity of the stream in feet per second. In this float method this velocity was obtained by throwing the willow twig or like object into the
185 stream and timing its flow between two points, the idea being that the travel of this float would give the maximum surface velocity of the stream as there was very little submergence of the float in the stream. Then the rule, as stated, was to multiply this observed velocity of the float by .8 to get the average velocity of the stream. The flow of the stream then was equal to the average cross section multiplied by the average velocity obtained. The use of .8 in the manner I have stated is the customary coefficient to apply where this method is used for instance, in the State of Utah this instruction is given to water masters over the country by the State Engineer to use this maximum surface velocity method, using the .8 coefficient, the idea being that it was approximate. .8 was determined from experiments made on natural streams and artificial channels, mainly in the eastern part of the United States and in Europe, and most of the deductions from which this .8 coefficient comes has been by American Engineers, and from the experiments of foreign Hydraulic engineers. None of these experiments were made in mountain streams to my knowledge. I have an authority which states that very careful use must be made of this .8 coefficient. From my personal experience and knowledge, the coefficient .8 should absolutely not be applied indiscriminately, irrespective of the character of the conduit through which the water to be measured flows.

This coefficient .8 will give correct results when applied to maximum surface velocities obesrved in worn wooden flumes, irregular concrete lined canals with rough surfaces or on the best quality of earth canals or channels which are silted in and have a smooth section and are free from vegetable growth.

The roughness of the stream bed is mainly responsible for the variation of the coefficient from .8 which should be applied. The greater the degree of roughness the less should be the magnitude of the coefficient applied. The velocity of the water effects the coefficient which should be applied. The higher the velocity in the section the less the area will be in relation to discharge of the stream. The rough effect of the bottom gives a degree of roughness proportional to the magnitude of the area of the stream. I would not apply the same coefficient on a straight section of say 20 or 30 feet,

or any number of feet, that I would apply on a crooked section, because steam bed conditions are different and these coefficients are intended to apply to straight sections.

186 I know where the Snake Creek tunnel is. ·I am familiar with the country between the mouth of this tunnel and the mouth of the canyon. I am familiar with Lavina Creek and the other natural streams that flow into Snake Creek and have made measurements of all of them. I am familiar with the contour of the streams and with the stream beds, and with the surface of the water flowing down the streams, as to whether or not it is generally rough or smooth.

It is my opinion that the quantity of water of these streams cannot accurately be obtained by use of a float measurement. If a float measurement is attempted to be made of these streams, it is my opinion derived from experiments, study and knowledge obtained from books, which treat upon the question, that the coefficient .8 should not be applied to determine the velocity because of the varying degree of roughness of the stream, which in all cases is very much greater than that for sections in which the .8 coefficient is applicable.

I have not been able to discover in any book I have studied which purports to lay down any rules for the application of the coefficient .8 under the formula which I have stated or what modification should be made of that coefficient when applied to streams similar to Snake Creek and Lavina Creek.

I have performed experiments and made investigations and [calaulations] which enabled me to state what percentage of error, if any, exists in float measurements when made on mountain streams similar to Snake Creek and Lavina Creek and I have reduced the work and results obtained to writing.

On the accompanying tabulation is an analysis of twenty measurements made on mountain streams by current meter using the six-tenths depth measure of velocity observation.

A current meter is generally used for the purpose of determining the flow of water through streams. The meter I have here is known as a small Price electric.

A large number of experiments have been performed so as to determine at what point from the water surface to the bottom of the stream it is possible to hold the meter and get the average velocity from the surface to the bottom of the stream. These experiments have shown that if you hold a meter at six-tenths depth you do get a velocity which is the mean velocity from the water surface to the bottom of the stream; the velocity at the six-tenths depth is the velocity you take. The result- of 1,600 experiments show that the

187 velocity at the six-tenths depth divided by .85 will give the surface velocity. The surface velocity is greater than the six-tenths velocity; the velocity the float would show if accurately timed on the surface of the stream.

I have prepared a summary of my observations and reasons on the typewritten sheet I hold in my hand in connection with current meter measurements to determine whether or not a float measure-

ment of streams like Lavina Creek or Snake Creek would give the correct flow of the quantity of water through the streams and the extent or percentage of that average.

Examination on voir dire.

By Mr. Wedgwood:

On this tabulation I give only the maximum depth of water at the points where measurements were made. I took a number of depths so all of the data is not on here. There was no actual observed velocity. I did not actually make any float measurements. This table is merely a theoretical computation on assumption that the fastest float measurement made upon the surface would be 85 per cent of the maximum at six tenths depth. All of these twenty comparisons are theoretical.

Mr. Wedgwood: Now I move to strike out all his testimony in relation to [th-se] twenty measurements where he said he had—he conveyed the idea or attempted to that he had made actual comparisons between twenty float measurements and the meter measurements.

The Court: It may be denied because that impression, though it might be so, will be corrected by the testimony that now comes.

Mr. Wedgwood: Save an exception.

The Witness: I did not intend to convey the idea that I had actually made a test by float for any one of these twenty measurements referred to here. My experience was at other times and other places.

Q. I will ask you to proceed to outline the experiments you performed and the work you did for the purpose of determining whether or not the float measurements in these natural streams in the Snake Creek drainage area would give an accurate result as to the quantity of water flowing in the streams, and if not, the percentage of error.

188 Mr. Wedgwood: I will object to it as immaterial and irrelevant as to any issue joined here and incompetent for the purpose for which it is introduced or for any purpose.

The Court: The testimony will be taken. The objection overruled.

Mr. Wedgwood: Kindly save an exception.

The Witness: For this tabulation I have taken twenty measurements; ten were secured on Snake Creek in the vicinity of the Snake Creek tunnel; five are made on tributary streams of Snake Creek. I took five other measurements on streams which were as like as to the flow as I could find within this region. These were on Mill Creek, Porter Creek, American Fork and the Provo river.

The first four columns of the tabulation beginning from the left are for the purpose of identifying the measurements. The next six are the copied results of actual current meter notes. The last

four have been arrived at by computation and each column by its heading indicates what the figures stand for in that column.

The one measurement identified as No. 12 was made in a timber rating flume. No. 13 is a measurement of a small canal. The percentage of error of these two is shown to be much less than on those which were taken in the natural stream bed.

In taking a current meter measurement more than one measurement is taken across the stream. That is illustrated on Exhibit 124 at the top. The vertical lines represent the point at which the observations of the depth of the stream were obtained. The figures at the top of the vertical black lines represent the distance apart of the points. The figures along the side of those vertical lines represent the depth of the water at that point and the figures to the right of the lines in the body of the section represent the velocity in feet per second at that point, which were six tenths of the depth of the surface.

In making my calculations the result of which are spread upon Exhibit 123, I selected the highest velocity at the six tenths depth, because it was assumed that the highest surface velocity would be immediately over the point in which the observation was made. In taking a float measurement the highest surface velocity is taken; I mean theoretically under the rule I have heretofore given. That result is stated on Exhibit 123 under the column headed "Computed surface velocity, using six-tenths depth, velocity
189 equals .85 of surface velocity." The next column means
that the rule given for making maximum velocity measurements requires that the maximum surface velocity observed be multiplied by .8 to get the mean velocity. In measurement No. 1 the computed flow was 3.71 second feet. The actual flow from the current meter results was 2.91 second feet; the theoretical error is the difference between the two which equals .88. This amount of theoretical error divided by the actual flow of 2.91 shows the theoretical error to be plus 27.5 per cent.

Edgar M. Ledyard, a witness produced by the plaintiff testified in substance as follows:

I am a farmer; have farmed in Michigan, California, and Utah and have been Dean and Professor at the College of Agriculture, University of Phillipines. At present I am in charge of the Winchester demonstration farm in Salt Lake County.

I spent three days at Midway and on Snake Creek a week ago. I have made a [rought] sketch of the district showing places where I went which has been marked Exhibit 125. On the lower left hand corner there is listed 25 different places. I examined some of them specifically; some casually; I was not able to actually locate all of them. The figures opposite the name in the lower left hand corner correspond with the figure in the circle on the plat itself and indicate generally the location of the place. Snake Creek is outlined by two parallel lines with the words "Snake Creek" between them. Midway is indicated by a parallelogram with Midway

inside. The irregular circle or curved line marked "hotpots" and "rockpot" represents the location of one large hot pot, several small ones and the so-called pot rock. The principal part of the area is given over to grasses for the forage of animals and there is some alfalfa and grains of different kinds. Alfalfa is also referred to as Lucern. In my opinion 15 to 20 per cent of the [*filed*] are covered by alfalfa plants and the remainder of the ground is given to grasses, and on the Cannon farm particularly weeds and thistles were very numerous; dandelions general too.

Exhibit 126 is a photograph I took to illustrate that condition. It represents the condition of a northeast alfalfa field just south of the part marked "Midway" and with the legend "alfalfa" on it.

Mr. MacMillan: I offer it in evidence.

190 Mr. Wedgewood: I object to it as incompetent. The photograph shows for itself and he has testified it was taken through a fence so it is about from two or four feet high from the ground.

The Court: The photograph may be received and if necessary he may identify what represents the lucern.

Mr. Wedgwood: We save an exception.

The Witness: The lucern in the photograph is represented by the outstanding and higher clumps scattered over the picture. The balance or lower portions of vegetation represent pasture grasses. You could not expect to raise a maximum crop of lucern from a field in the condition in which I found that field.

I would say that generally over the district the lucern fields are more than eight or ten years old.

Mr. MacMillan: I will ask you whether or not you would expect to receive a maximum yield of lucern where the lucern has reached that age.

Mr. Wedgwood: I object to it is incompetent and immaterial as to any issue joined in this case.

The Court: It is to meet the proposition of the testimony of some of the witnesses that stated the flow had been decreased since the tunnel had been made?

Mr. MacMillan: Yes.

The Court: If for that purpose he may answer.

Mr. Wedgwood: We save an exception.

A. Not where it has reached an age of more than eight years.

The Witness: The alfalfa field I observed would compare generally with the one the picture shows; some are better and some are worse.

[—] I examined the grain crops generally.

Mr. MacMillan: You may state whether or not you saw anything there to indicate a lack of water.

Mr. Wedgewood: I object to it as calling for pure conclusion of the witness.

The Court: You may answer.

Mr. Wedgwood: We save an exception.

191 A General good condition and not suffering for lack of moisture.

The Witness: I made trips over this district in 1915, 1916 and 1917. The trip of 1916 was for the specific purpose of testifying in this court. The trips of 1915 and 1917 were for pleasure and casually looking at the condition of the crops. In 1916 there was a piece of wheat that was suffering from lack of moisture, but generally on the area along the road, no lack of water and rather an abundance of green grass was noticeable.

I found ground that was swampy. It is indicated on the map. In this swampy district I found a number of perennial plants, broad leaf grass and water cress and sedges, and along the bank willows and other what might be termed water vegetation.

The swampy area would cover from 40 to 60 per cent of the district that is indicated on this map, not drawn to scale and occurring along Snake Creek and north and west of the point where the Provo river crosses the road and that low area which includes Midway to the outline of the hot pots. In my judgment, the condition I found there, at the present time could not exist if there had been a scarcity of water during the months of July and August in the years 1916 and 1917.

I made investigation of the soils in the district at the points indicated on the map by the word "borings" and we also examined holes dug to a depth of about five feet where they were excavating for a power line. The creek surface was about seven feet below the surface of the soil, and at the point where Snake Creek crosses the main road we encountered saturated earth at a depth of about two feet; then going to the creek bottom and boring down seven feet to the level of the water, we encountered "hardpan" which we could not get the auger through. A week ago Saturday we made borings in the same creek bed and encountered the same general condition. At the surface of the water in the creek we encountered the water table but the holes along Springtown road which were dug to about five foot depth were entirely in clay and were not moist; I should judge there was no water in them.

I should guess there may be two or three hundred acres of this potrock land.

192 Cross-examination:

We made our first borings at the point where Snake Creek crosses the main road from Charleston to Midway; that was on the lower land down by the creek bed. I examined the excavations made by some company engaged in erecting a power line along the Springtown road, they had fifteen or twenty open holes, at a place indicated by No. 13.

I saw some springs breaking out down along the brow of the hill just above the lower lands. The perennial plants referred to may have been growing a thousand years.

The Midway country has a general appearance of Eastern New England; particularly Maine. I would not call the Midway district a characteristic western district. It maintains vegetation different from the ordinary desert condition. I saw both timothy hay and lucern growing there. It is a good stock district. The two or three hundred acres of the potrock district were thin solid and dry. All I know as to whether or not there is irrigation from the Midway Irrigation system below the road from Charleston to Heber is that a ditch comes out there and that there was water running out.

You would expect to find in that creek bottom the coarser gravels and clay, and that is what I did find.

Fred Mathews, a witness produced by the plaintiff, testified in substance as follows:

I am an agriculturist and farmer and I was educated along these lines in an Agricultural College and by practical experience. I was with Professor Ledyard when he made his trip to Midway about ten days ago. I heard him testify.

I prepared this map identified as Exhibit 125. It was not the intention to lay off the places on it according to scale; simply to show their general relative position.

We made examination of the crops generally. The lucern generally was in what we might say, a run down condition; it was grassy and filled with grass sods and dandelions. I was present when the photograph marked Exhibit 126 was taken.

I would not expect to produce maximum crops of lucern on fields in the condition such as represented by the photograph and as I have described. The alfalfa fields were very old, comparatively
from five to six or seven years. The fields we examined did
193 not show evidence of cultivation. We do not expect to pro-
duce fair crops of lucern without cultivation. We did not find fair crops. Some of the other lucern fields were not as good and some were better than the field shown in the photograph, though generally in the whole district I did not find what we might term a good field of alfalfa.

Q. What effect does it have on land to permit one class of crop to remain on the land for a number of years?

Mr. Wedgwood: I object to it as immaterial under any any issue involved in this case.

The Court: He may answer.

Mr. Wedgwood: Save an exception.

A. You do not get maximum crops where a system of crop rotation is not practiced.

The Witness: I was present when the photograph marked Exhibit 127 was taken. It was taken on the road leading west to the Springtown road. It shows a swampy condition along that road. Standing water can be seen in the foreground in the picture. It also shows the grasses growing in the swamp.

Exhibit 127 received in evidence.

The locality where this picture was taken does not show that it has been subject to any drought for several years back.

Cross-examination:

The place where Exhibit 127 was taken is on the main road from Charleston to Midway, in the area marked "M" on the north side of the road. It is an area of from three to five acres. There is another "M" of about seven or eight acres in a swampy condition. I found timothy up there, that is a perennial plant. That is a section of the country that is famous for timothy.

EDGAR M. LEDYARD, recalled for further cross-examination, testified in substance as follows:

I would say I observed two thousand acres of land under the Midway system. I would not say that from forty to sixty per cent of the two thousand acres I think I saw were swampy; not of the grain land, but on the lower land on either side of Snake
194 Creek, relatively two thousand acres of that, forty to sixty per cent were swampy lands.

By "the lower lands" I mean land where the water table is very close to the surface, where water cress, broad leaf grass and water grasses grow, and where I saw nothing but pasture grass, no cultivated crops, not all covered with water but water visible at many places and evidence of water in many other places.

I could not circumscribe the boundaries of the four thousand acres of land irrigated by the Midway Irrigation Company, I could not lay it off on a sectional map. There is no scale to this map. What I have [represenred] as four hundred or five hundred acres of wet land on the map is too big; it is exaggerated. I indicate roughly upon Exhibit 1-*a* the four or five hundred acres of swampy land. Within the red lines is what is irrigated from Snake Creek. I have indicated with a blue pencil the swampy lands by the irregular lines.

The acreage of the one marked farthest to the north I can give approximately as sixty acres; the one below that 477 acres. They are not solid swamps; intermittent swamps, generally swampy. When I say intermittent swamps I mean occasional high raises of ground with dry spots. There are ditches along the outside of the fields. I hardly think any water was diverted on it for irrigation. I do not recall any going on the fields. I saw no indication that it had been irrigated land in the ordinary sense.

Redirect examination:

The place I have marked as indicating swampy land are places bordered by a blue line; the uppermost being in the northwest quarter of Section 35. The northwest quarter of Section 34, the southeast quarter of Section 27, and the southeast quarter of Section 26, as shown on Exhibit 1-*a*, and the others are immediately below that on the map, and the number of acres covered are indicated by the figures in the blue within the border lines.

F. S. HARRIS, a witness produced by the plaintiff testified in substance as follows:

I am professor of Agronomy of the Utah Agricultural College and Director of the Utah Experiment Station. I have had practical experience in farming by irrigation methods. I have
195 made examination of the districts surrounding Midway. The most recent was on June 3rd.

The character of the crops vary. The principal crops would be grass, alfalfa and grain; a mixture of various cultivated and wild grasses. Generally speaking, I would say the lucern crop was not in the best condition. In most cases the alfalfa plants did not cover the area which was planted. There were spots occupied by grasses or weeds. I saw no lucern, speaking generally I should say it was old. In going over the fields it was my opinion that the lucern would yield more if it was renovated, plowed up and replanted. I saw no evidence of cultivation on the lucern fields.

I saw land which was exceedingly wet. It would be swampy in one definition of the word. I suppose most of the plants growing there were perennial. In my opinion the condition of the vegetation in that area had existel for several years and would indicate a continuous wetness.

Q. Can you state whether or not it is a general rule that farmers throughout the State use more water than is necessary for the growth of their crops?

Mr. Wedgwood: I object to it as incompetent.
The Court: I suppose it is preliminary. He may answer.
Mr. Wedgwood: Save an exception.

A. For each crop there is a certain moisture content; if more than this amount is given or less than this amount of water is given the crop yield is reduced. By this reasoning any excess does produce an actual decrease in yield of crops, as has been demonstrated many times in our own experiments as well as those in all parts of the irrigated section.

Cross-examination:

I do not remember the experiment of Dr. Fortier but I believe we can assume that for grasses, under certain conditions you could use to advantage probably three acre feet per acre applied to the plant, ignoring all losses in transmission and all losses except transpiration and evaporation.

H. L. Stoner, recalled for further direct examination, testified in substance as follows:

In my opinion the results shown in the last column of my tabulation under the heading, "Per cent of error of computed flow
196 compared with meter flow," indicate percentages that are practical; they are entirely practical because they have been arrived at by a method obtained by experiments and experience.

I have represented on Exhibit 124 at the top of the map two cross sections across two different streams. The one to the left is a

graphical representation of measurement No. 3. The figures 7.47 is the area of the cross section. It is obtained from the average depth multiplied by the width of the section. The average depth is obtained by adding up the depths of the sides of the section and dividing by 2. The width of that section is the difference between 2 and 3 feet or 1 foot. The area of each particular section between depths measured is obtained in the manner I have pointed out. After I obtained the area of each of these sections I obtained the total area of the cross section by adding together the area of each individual section.

By the tabulation on Exhibit 123 the fact has been brought out that on the 18 streams in natural stream beds the error varied from 116.5 per cent to 22.2 per cent. I am able to deduce from this tabulation that the percentage of error resulting is due mainly to the roughness of the stream bed and its relation to the size of the cross section of the measurement involved.

I have made a plat for the purpose of illustrating. It is marked Exhibit 124. This chart has been made up from the results of two actual current meter measurements. The one on the upper left hand corner is represented by No. 3 on Exhibit 123 and the measurement was taken at the Mountain Lake road crossing on Snake Creek. The one in the upper right hand corner represents the cross section at which measurement No. 6 on Exhibit 123 was taken and that location is 25 feet above the Mountain Lake road crossing on Snake Creek. These two cross sections are actual cross sections at points where measurements were taken on streams in controversy in this suit. If actual floats had been placed in the stream at the time the current meter measurements were made, it is my opinion that the percentage of error would be greater than is shown by my deduction, I mean it would be even greater than the percentage set down and shown in the last column of Exhibit 123. Further explaining Exhibit 124. After the cross section of the stream has [*g*een] developed in order to ascertain the flow of the stream in second feet, it is
197 necessary to obtain the mean velocity of the water flowing
through the section. This is done at the same place in the [section*a*] at which soundings were made from which the depth was obtained. The meter was held in the stream at a point which was six tenths of the depth of the stream at this point from the surface.

On the diagram I have marked by figures set opposite the small circle the actual velocity of the stream as determined by the current meter. Having obtained those velocities across the section, the next thing is to determine the average mean velocity of each individual section between the velocity lines. For the section to the extreme left the velocity at the edge was zero. Under the distance marked "2 feet" the velocity was .8; therefore the mean velocity for the section is obtained by adding zero and .8 and dividing by 2; the result would be .40 which would give you the mean velocity. Likewise the velocity is computed for each individual section between the distances. The flow in cubic feet per second is obtained by multiplying the number of square feet of a section by the actual mean velocity obtained in that section which in this particular instance

amounts to 7.96 cubic feet per second. In the same manner I obtained the flow and the area of the section to the right by a cross section of the measurement which is No. 6 on Exhibit 123. Below those two sections I have two curves. That on the left hand side is a representation of the horizontal distribution of the velocity at six-tenths depth.

The purpose of the diagram of horizontal distribution of velocity is to show how it varies from the bank through the section to the other bank.

I have also [-repared] a curve for measurement No. 6 and that is represented on map 124 under the cross section at the right. That curve was prepared in the same manner as I prepared and explained the curve for measurement No. 3. The upper left hand section is a section across about 12½ feet in width; the one to the right is about 8 feet in width. The countour of the perimeter is different in the two sections and the depth varies in the two sections. There is a marked difference between the two curves. In measurement No. 3 the flow was 7.96 cubic feet per second. In No. 6, 10.60 cubic feet per second. The flow in measurement No. 6 was roughly one-third larger than it was in No. 3, but in measurement No. 3 the area was 7.47 square feet while in No. 6 it was only 4.17 square feet. In other words, the area for measurement No. 6 was roughly one-half of what it was in No. 3. The result of this comparison of
198 flow and area is that the mean velocity in No. 3 was 1.06 feet per second, while in No. 6 it was 2.62 feet per second. In other words, the mean velocity for measurement No. 6 was two and one-half times that for measurement No. 3. This difference in velocity accounts for the difference in the form of the curve shown under the cross section for measurement No. 6 simply being that for the small cross section of No. 6 the water had to flow much faster than it did to get through the cross section for measurement No. 3.

If a float were thrown into the center of the stream at 6 it would get the highest velocity, whereas if it was thrown into the center at 3 it would not get the highest velocity, if a short run was used. In order to determine the highest velocity in a stream by float measurement, it would be necessary to drop a number of floats in a stream at different points on the surface. In a section such as is represented from measurement No. 6 where the area is relatively small compared with the flow, the percentage of error occasioned by the roughness of the stream will be greater than for a cross section such as is shown for measurement No. 3, wherein the relationship between the area and discharge is relatively small. The actual figures of percentages which I obtained from measurement No. 6 and 3 are 34 per cent error for measurement No. 3 while for No. 6 the percentage of error is 63.7 in which the relationship between area and discharge is comparatively great. This can be borne ont by other measurements on the tabulation. I have in mind No. 20 on Exhibit 123. This was made on the Provo river below the upper Midway dam. In this case, the roughness of the stream was even greater than for two measurements illustrated on Exhibit 124. The percentage of error is not as great as it is from either of the two

measurements No. 3 and No. 6. The reason for the percentage of error in this case being less than for measurements No. 3 and 6 is because the relative roughness of the stream was not as great as it was in those two measurements. Roughness is a relative term which states how rough the section is compared to the area of the stream which is affected. In this measurement No. 20 the area was 66 square feet. The flow through the section was 61.3 cubic feet per second. This gives a mean velocity through this section of .93 feet per second which is less than the mean velocity obtained in either measurement No. 3 or No. 6. In other words, if a stream were not rough, the percentage of error would decrease; if it were rough the percentage would increase and the increase would be proportionate to the increase in the roughness of the stream itself.

199 Referring to Exhibit 123 and measurements 9 and 2. No. 9 shows the maximum error I obtained from a comparison of surface velocities. In this case measurements were made of the flow in the weir channel of the old concrete weir on Snake Creek which is now abandoned. The current meter was used. The stream was very shallow and rough and the relationship between area and discharge of flow was such that the mean velocity was comparatively high. That is what you would expect to find in a shallow and rocky stream. The roughness of the cross section for this measurement was greater than for any other measurement under consideration. Measurement No. 2 was made at another time on Snake Creek at the Mountain Lake crossing. This measurement shows the smallest percentage of error of any one made in natural stream beds included in the exhibit. This is accounted for by reason of the degree of roughness. The flow through this section was 2.98 cubic feet per second. The area was 5.53 square feet. The mean velocity .54 feet per second. The area in this case was large compared with the discharge and consequently the effect of roughness on the cross section was much less than for the other measurements. This verifies my conclusion that in a general way the percentage of error resulting from float measurements will vary according to the roughness of the stream.

No. 12, or Exhibit 123, was taken in a rating flume. The flume was made of timber and had been in place for several years. A slimy growth had developed on the lining of the flume. This cut down the roughness of the channel to a very marked extent so that the flow through this section was very rapid and very smooth. The percentage of error found was only .45 per cent, or correct. No. 13 was made on the West Bench canal; an artificial ditch constructed from earth and the section was relatively smooth.

I used the co-efficient .8 in making my calculations for all of these exhibits. I used it for two reasons. I made these computations to duplicate the work of a man who had always applied the co-efficient .8 indiscriminately to all of his measurements and because I did not know the proper co-efficient to apply to float measurements of all sorts such as have been shown for this comparison, because there are no authorities of record to which I have had access from which this co-efficient could be obtained. So far as I know, the proper co-efficient

of streams of the character of Snake Creek has not yet been developed. My conclusion is that except in cases where there is a flume, as in No. 12, there can be no co-efficient developed that
200 would give any certainty. We cannot determine the roughness of the streams sufficiently close to develop a co-efficient which we can apply in such cases. In other words, in my judgment, float measurements are valueless for determining the flow for the reason that we cannot determine to a sufficient degree of exactness the roughness of the stream so we can apply the proper co-efficient of correction.

The co-efficients which have been developed by the engineering profession are the results of actual experiments made by taking float measurements simultaneously with measurements of the same stream at the same point with either a current meter or weir. From those measurements there has been d-veloped a table showing varying co-efficients, on various kinds of streams with respect to the roughness or smoothness of the stream. The table I refer to is found on page 224 of a booklet entitled "Re-print from Journal of Agricultural Research, Washington, D. C., November 8, 1915, Volume 5, No. 6, Experiments in the use of Current Meters in Irrigating Canals, by T. S. Harding." That table is found at the bottom of page 224.

On page 226 of the same book is found a description of the various conduits, streams or ditches from the smoothest to the roughest to which the co-efficients found in the table at the bottom of page 224 may be applied. They run from the straight wood flume in good condition, as the smoothest, to earth canals containing much moss or weeds, irregular section, gravel or cobbles, fairly smooth rock cuts as the roughest.

Without a correct co-efficient which has been developed in the manner I have described these co-efficients in the table have been developed, in my opinion, no engineer by any known method can make a correct or accurate (float) measurement of the flow of such streams as are found in the Snake Creek area.

The error found by using the co-efficient .8 in natural stream beds such as are found in the Snake Creek area in my opinion would be always plus; that is, the measurement made by the current meter would be less than those of float measurement, consequently the float measurement is in error plus, and may be in error to exceed 100 per cent. According to the table on page 224 of the [rook] referred to, where the area of the water cross section is two square feet, the range of the co-efficient to be applied varies betwen .85 and .60 for the values of "N" varying from zero, .012 to zero .030. The
201 value 0.012 refers to the straight wood flume in good condition and the value 0.030 refers to earth canals, much moss or weeds, irregular section, gravel or cobbles, fairly smooth rock cuts. This is with relation to Cutter's formula for use with the value of "N." "N" is eliminated when you use a current meter. Cutter's formula does not enter into current meter measurements. Whether the sides or bottom of the stream be rough or smooth does not enter appreciably into the accuracy of measurements made by meter; nor is it applicable to measurements made by a proper weir.

If you had a stream where the value of "N" is .030 and the area two square feet and you used the co-efficient .85 instead of .60, the percentage of error would be 42 per cent, so that as the area varies the co-efficient must vary and if the area increases or decreases and you fail to change your co-efficient, there would be an additional percentage added to the percentage of error.

You do not use Cutter's formula where you know the value of "N." When you know the proper co-efficient there is no necessity for the use of Cutter's formula. When a float is put on the surface of the water it rides down on the surface just as fast as the water flows and no faster and no less. When you take a current meter measurement you place your meter to the six tenths depth of the water. As the water flows by it gives you the actual velocity of the water at the six tenths depth.

Q. Now by resorting to the figure which has been developed by these measurements of over a thousand, namely, .85, you can actually get, without any theory at all, the actual velocity of the water at the surface over that point can't you?

Mr. Wedgwood: I object to the question as being argumentative, being a conclusion which is deduced from stated data, not an expert opinion, and a question which must call for a misleading answer.

The Court: It may be received.

Mr. Wedgwood: Kindly grant me an exception.

A. Yes, sir.

Cross-examination:

I made most of the meter measurements referred to in Exhibit 123. The balance were made under my direction.

I obtained the cross section areas shown on Exhibit 123 by measurements made at the time and place. The only other
202 actual measurement, by the use of instruments, upon this table is the maximum velocity at six tenths depth below the surface. All of the rest are assumed, deduced or gathered from experience.

The authority I referred to in regard to the average of 1,600 measurements is in Hoyt & Grover's River Discharge, on page 58 of the 1912 edition.

The drawing I made by request during the intermission is Exhibit 129. The figures 2.7 on the left hand side represent a distance from a point on the bank on the opposite side of the stream; the 2.5 a distance of 2.5 from that point and the same is true of 2.2; the 1.7; the 1.1 and the 0.8. This is No. 13 on Exhibit 123.

The width of the water surface at the top was 2.2 feet. The other .5 feet is on the right hand bank between the zero point on the tape and the .5 point on the tape. At .8 from zero on the tape the depth was .2 of a foot; at the point 1.1 feet from the zero mark it was .25 of a foot. At 2.2 from the zero mark it was .2 of a foot, and at 2.5 from the zero mark it was .15 of a foot. The top green irregular line represents the water surface.

There are three or more ways of measuring water given in the book I referred to this morning, by Hoyt & Grover. The most accurate is by developing a vertical velocity curve; then there is the six tenths method, so-called, which I have used and there is the two-tenths—eight tenths method which approximates closer to the vertical velocity curve than the simple six-tenths method. Then there is the intergraded method—so-called. What have been referred to are the different characters of meter measurements. Then we have the float measurement. That is treated of at some length in Hoyt & Grover. Then the third measurement is a velocity measurement, usually worked out by Cutter's formula given here in the book.

Hoyt & Grover is a recognized book of standard authority. In regard to co-efficients, it says: "Velocities observed by them must, however, be reduced by a co-efficient. The magnitude of this co-efficient varies between 0.85 and .95 depending upon the discharge and character of the stream as explained on page 54." I am not sufficiently acquainted with the article to know whether or not he is taking the mean of the surface velocity as the factor to be multiplied by .85 or .95. I do not know whether I would expect that factor to be the mean and not the greatest velocity.

203 You understand me to say that the measurement of the velocity of a stream six tenths below the surface of the water gives the mean flow of that filament, the error in different streams may vary slightly so as to make an error possible to the extent of four per cent. This error may be either plus or minus and the average resultant error will be practically zero.

In regard to error of the six tenths measurement Hoyt & Grover says: "The error resulting from the use of six tenths depth is very small, ranging from minus 6 per cent to plus 4 per cent. Therefore in the six tenths depth method this assumed velocity at six tenths is the mean velocity in the vertical, and the meter is held at that point in the method." As far as I know, measuring at the six tenths depth below the surface gives the mean of that vertical filament within that error in all streams of all characters.

I do not assume to know all there is on the subject to which I have testified. I directed the making of Exhibit 123. I made this exhibit for the purpose of showing the probable error which would have resulted in the taking of measurements by maximum surface velocity method for the purpose of showing what the percentage of error would be in flows computed by the two different methods.

The whole thing turns on the question of the surface velocity and the use of the factor of 80, or the necessity of using some other factor.

I believe the errors of my meter measurements were negligible and that Exhibit 123 is in general correct.

The results of this tabluation are only generalities. There is nothing in the tabulation which attempts to set down any method for correct float measurements. The only thing the tabulation does is to show that the variation of error in this float work plots all over a ten acre field. There is no definite positive conclusion to offer.

I said, as I recall, of those measurements which were made of the

natural stream bed, nothing was said in other books. So then, the fact is, I am putting out Exhibit 123 as original deduction from [person-] research by myself, and I consider the demonstration made by Exhibit 123 as fair to the engineering profession.

To the best of my knowledge, as to streams of the character I have expressed as to conditions in the twenty different expressions on Exhibit 123, I say that taking a measurement six tenths
204 below the surface gives the mean velocity of the vertical filament on which you take that measurment.

The coefficient .85 which I have used is the result of 1,600 measurements. Among them are some streams which I judge to be similar to those under consideration in this case; they include streams of all characters and include streams of the character expressed within the data on Exhibit 123.

When you use .85 in connection with the six tenths depth measurement, you add 15 per cent to the velocity developed at that depth in order to get the surface velocity. In obtaining the cubic feet per second flow, my process, in every case, amounts to dividing the maximum six tenths flow by .85 and then multiplying the result by 80.

The assumption that this 85 per cent was absolutely correct was necessary to make my computation. If .85 is in error, and not applicable to the character of streams I have exemplified, my figures and ultimate results are also in error.

In order to secure any accuracy under the six tenths method it is absolutely necessary to take the velocity at six tenths depth below the surface. The diameter of the cups of the current meter is two inches. The distance from the bottom of the yoke or bottom of the pin up to the top of the cup is two and five eighths inches.

Upon Exhibit 124 the elements I express vertical are upon a scale three times as great as the elements expressed horizontally. By reason of using these two scales the depth is distorted three times the actual fact with relation to the width; it is a customary thing; so that considering the exhibit as a simple picture and assuming the same scale as to width, it looks to be three times deeper than it is.

Under example 1, upon Exhibit 123, .62 would be the proper factor to use as a [jultiplier] to get the correct flow. In No. 2.66. In No. 9.38. In No. 12.80. In Example No. 1 I found the maximum velocity to be 3.58. My computed surface velocity is 4.22. The difference between them is .64. In Example No. 1 the mean flow as determined by current meter was 2.64 and I calculated the surface flow to be 4.22. The difference between the two is 1.58, which means that my computed velocity was 1.58 lineal feet faster in a second than the mean velocity as I found it. I find justification for such conditions in the table referred to on page 85 of the 1912 edition of Hoyt & Grover.

205 With reference to Exhibit 130, I notice there are eleven lines, two inches apart. That of necessity includes ten spaces. The first two inches would represent the first tenth of the depth of the stream. The second space, the second tenth and so on down.

In Example No. 1 upon Exhibit 123 my greatest total depth was five tenths of a foot. Four tenths depth is where I got my greatest velocity and it is represented by the broken line.

Exhibits Nos. 130 and 131 received in evidence.

I have marked upon Exhibit 130 the position where I had the meter cups when I obtained the data for demonstration No. 1 where I found the greatest velocity and I have written on the exhibit, "Proper setting of meter to be six tenths in depth from the line marked .4 from the bottom."

On page 58 of Hoyt & Grover there is a table of stream measurements showing the factors of velocity made up of many observations. I am sufficiently familiar with it to use it as my warrant for the deduction and use of factors in this demonstration on Exhibit 123. I would still say that I find warrant for the use of .85 as a factor to determine the surface velocities of the examples in Exhibit 123 from this table.

Page 85 of Hoyt & Grover on stream measurements received in evidence.

In this table there are 81 tabulations. On many of the streams, very many vertical velocity curves were applied; on one as many as 50, and only one where there is but one, and then they range from three to fifty. It means that upon one there had been 50 vertical velocity curves taken and considered in making up the data for that particular stream in the table and where there is 23 determinations it means there were 23 vertical curves taken and so on according to that principle.

The shape of the vertical curve varies in different characters of streams. As shown by the figures, the vertical velocity curve was different in every one of the different streams measured to make up this tabluation. All streams have the same characteristics as evidenced by vertical velocity curves, regardless of their shape or character. If you have a stream 20 feet wide and from one and one-half to three feet in depth, and another of the same width and substantially one and one-half feet in depth, I would expect the vertical velocity curves of the streams running out about the same velocity to be the same. Each stream has its own individual shape.
206 There would be a general resemblance only. That is the best answer I can make.

I presume that the nearer streams are similar in character to each other, the nearer the shape and characteristics of the curves will be. If you have two streams of substantially the same character of the same depth and width, and with about the same form, you would expect the characteristics of the vertical velocity curves to be quite similar, but I am not prepared to say that the wider the difference from that character of a stream the wider the difference between the shape and the velocity curve will be. I presume that is the case, but I cannot state it as a fact.

If you have a stream which is from three to ten feet deep and fifty feet wide with a small velocity and another swift running stream from two to five feet in depth and twenty feet wide, the shape of the curves will be probably different. The examples I have seen have been different. The statement is generally true that streams of dif-

ferent character have different shaped curves. The different shape of curves, even in the same stream, is illustrated by the second figure on page 54 of Hoyt & Grover. The curves which are developed from measurements taken in a vertical line in the shallower portions of this stream show the maximum velocity of the stream at that point is nearer the surface than where the velocity curve measurements are taken in the deeper part of the stream. The second figure on page 54 of Hoyt & Grover received in evidence.

Directing my attention to page 58 of the same book to the left hand page, the top sub-division. The depth of the shallowest curve development in the stream, in any stream there exemplified, is 1.6 feet. That was the shallowest part of the stream where the measurement was taken. The greatest depth of the same stream was 8 feet. The greatest minimum depth of a stream measured in that particular subdivision was 10.9 feet and the greatest depth of that particular stream 17.5 feet. Taking the first sub-division on the right hand page, the shallowest point of any one of the streams exemplified is 1.1 feet and the greatest depth of the same stream is 6.6 feet. The minimum depth of the largest stream there exemplified is 5 feet and the maximum depth 36 feet. Below that there is still another class, swift mountain streams. The minimum depth of the streams there exemplified is 1.6 feet and the greatest depth of the same stream 3.2 feet. The minimum depth of the larger stream is 1.8 feet
207 and the greatest depth 4.5 feet.

The writer takes the first group and deduces his results from that separately from the others and then afterwards works out the second group. And then takes the third group and deduces independent results from that.

After inspection of all the measurements I threw the most weight on the shallow streams with a rough bed, and I found the co-efficient which was the mean of 219 curves to be .84 but to have a round number I used .85, which is also the mean of the second group and varies but two per cent from the mean of the first group. In the first sub-division the highest factor found was .98. In the last the highest factor .89, so that between those two groups there was .09 or a per cent difference and in the lowest there was .01 difference. In the second group the highest per cent was .95; in the last .89, which [wo-ld] be a difference of .06 and the lowest was .78 in both cases.

The deepest stream that is shown upon my notes and upon Exhibit 123 is 2.1 feet. That is No. 20. The least depth of the same stream where I took measurements is .7 of a foot. The respective measurements upon that stream following the .7 depth were .9, .9, 1 foot, 1, 1.2, 1.1, 1.2, 1.2, 1.4, 1.6, 2.1, 1.8, 1.7, 1.7, 1.4, 1.2, 1.3, 1.3, 1.6, 1.4, 1.3, feet and zero. That was Provo river below the upper Midway dam. So then the nearest stream I had to compare with the third sub-division of the table of Hoyt & Grover as to depth is a stream running from the first measurement of .7 of a foot up to 2.1 feet in depth, whereas of the streams that make up the third table, the smallest of them had a minimum depth of 1.6 and a maximum depth of 3.6. That is the nearest, so far as depth is

concerned I have in my Exhibit 123 to compare with the third sub-division on page 58 of Hoyt & Grover.

With reference to my notes, for example No. 13 on Exhibit 123, the least depth of No. 13 where an observation for velocity was made is .15 of a foot. One depth was 2, another .25, and another was .25. This is the shallowest stream I have on Exhibit 123, so that the shallowest stream which I have on Exhibit 123 to compare with the shallowest stream in the third sub-division on page 58 of Hoyt & Grover has a minimum depth of .15 of a foot and a maximum depth of .25 and the shallowest stream in the table is 1.6 feet in depth
at the minimum and 3.35 at the maximum, but I never
208 made this comparison. I simply took these tables and de-
duced what cœfficient to apply.

I never saw in any book anywhere a table or series of tables where the cœfficient for reducing a mean velocity was considered or deduced for streams from the size of those referred to in Exhibit 123. I have never seen in the technical books any table or worked out data that demonstrates or purports to demonstrate what per cent of the surface flow, or what the relation of the maximum surface velocity, is to the maximum velocity at six tenths depth in such streams as No. 20 on Exhibit 123. Nor have I seen any technical data regarding relation of such velocities in streams whose greatest depth was .25 of a foot.

I never made vertical velocity curves of a stream two feet in depth at the deepest place and seven tenths in the lessor. I cannot refer to any curve that has been worked out by anybody for a stream depth of seven tenths of a foot. 1.25 in depth is the shallowest curve shown in Hoyt & Grover. That is on page 54. I do not know where to find a shallower curve shown.

So far as demonstrated curves are concerned and so far as my deductions are concerned, I took and assumed that the character of the velocity curves in the streams of the character of 20 on Exhibit 123, and of 13 on 123 are similar to those of the last sub-division on page 58 of Hoyt & Grover. So far as results in cœfficients were concerned, I assumed them to be absolutely identical and that is based upon the six tenths depth method, all of it.

It is my opinion that the six tenths depth method and coefficients identical to those set forth in the third sub-division, is substantially correct as a coefficient for streams whose maximum depth is .35 and streams whose maximum depth is 2.2 feet and all grades between them, mountain streams and that is what my Exhibit 123 stands on.

The six tenths method is a correct method for determining the velocity of streams of the character shown on Exhibit 123 in my judgment within a small percentage of error. On page 57 it is said in Hoyt & Grover: "A study of vertical velocity curves shows that the mean velocity in verticals equals from 85 to 95 per cent of the surface velocity."

About the six tenths [methos] in relation to small streams—on page 62 in the second edition of the book it is said: "The method is
applicable over a wide range of conditions, is easy of execu-
209 tion, and is reasonably accurate for normal flow in straight
reaches of all streams except very deep and very shallow

ones." The author says this method is not reasonably accurate for very shallow streams and I say it is reasonably accurate for them. That is the difference between us. I do not consider myself a higher authority than Hoyt & Grover. I have a difference of opinion, that is all. I have not attempted in that tabulation to show exact proportions. All I now want understood from Exhibit 123 is that it is an indication. I do not say myself that it correctly determines the inaccuracy of the coefficient.

When we speak of a filament of water we mean a thread of the flow of water, and the filament which has the same velocity, even if that filament is continuous, does not ordinarily move in a straight line. In other words, the filaments of different velocities in a stream when platted show almost the same condition as counter lines in a rough country.

In a small swift running stream with a rough bed there are different velocities scattered all through the current. That is graphically shown on figure 1, page 54 of Hoyt & Grover.

Page 54 of Hoyt & Grover received in evidence.

The open part of the cups of the current meter is two inches in diameter. The cups are cone-shaped with the cone of one regularly behind the cone of the other. These cups take the different [rhreads] of velocity, whatever they may be, for a space of two inches in depth of the stream, so that all the different velocities that may be within the limits of the two inches embraced by the cup act upon the cup and effect the number of revolutions and the velocity shown. You have from the reading taken the composite velocity of the velocity within that two inches of the stream that effects the cups. In other words, when the meter is at the six tenths depth you get the composite velocity of two inches in depth of the stream on a width equal to the diameter of the wheel (of the meter) horizontally, which is five inches.

You understand me that my use of .85 to determine the maximum surface velocity was in connection with the maximum six tenths velocity, there is no question about that. As to coefficients relating to six tenths depth, maximum six tenths [velocit-] is not found nor mentioned or referred to in the tables on page 58 of Hoyt & Grover.

210 The coefficient in Hoyt & Grover under the head of six tenths depth is the actual velocity derived from an average of a number of determinations made of the different vertical measurements of velocity of each particular stream. My table 123 shows in a column the maximum velocity observed in sections at six tenths depth. I take this maximum velocity observation because the method which I am comparing used the maximum surface velocity. Hoyt & Grover show the relationship between the surface velocity and the velocity at the six tenths depth. The six tenths velocity which they show is an average velocity across the stream at that depth.

As to what warrant I find from this table in Hoyt & Grover for using the maximum velocity at six tenths depth as a factor in connection with .85—to this extent, the book was not used for a guide;

the book did not tell me the method to use in preparing this tabulation. On the face of it there is nothing in the table or in the text of the book in relation to maximum velocity at six tenths depth, with relation to the coefficients expressed on the page.

The highest velocity at six tenths depth has a definite percentage relation to the maximum velocity surface flow. This relation may or may not be .85. I have used .85 and predicated Exhibit 123 on .85.

There is a definite percentage relationship between the maximum velocity at six tenths depth and the mean velocity of the stream. This percentage relation is just as reliable as the one we had before of .85. If the maximum velocity at six tenths depth has a definite percentage relation to the mean velocity, then the maximum velocity at six tenths depth would have a definite percentage relation to the discharge of the stream. That percentage is as truly a constant as .85 is a constant with relation to the maximum [surface] velocity. I determined by actual demonstration the mean flow of the stream. I also determined the maximum velocity at six tenths depth of the stream and I say there is a definite percentage as to coefficients between those two. When that definite percentage is applied to the data I have in each case, and when compared with the other, the percentage of discharge ought to compare consistently. I do not know whether the percentage relationship of the maximum flow (velocity) to the mean flow (velocity) shows an absolute consistency of over one hundred per cent in my table 123, I have not made the check.

The weighting rod used in connection with the meter I have illustrated graphically on Exhibit 129 at the figure "B."
211 The section on the left hand side is the section of the meter that would be placed in the stream at right angles to the current; the section on the right hand side being the view of the rod that would appear were it placed in a picture of the cross section. The figures .1C to C between two squares means there are holes bored through this strap iron of which this rod is made and these holes are one-tenth of a foot from the bottom of the base. When I made these measurements I used that weighting rod in all cases, I could put the meter at the lowest hole. The meter will operate when the lowest hole is used. I may or may not have used the lowest hole in the making of these measurements, I do not know. If the last hole was used, the cups would be one inch above the level of the foot of the weighting rod. If the shank of the meter was supported in the last hole the center of the cup would be 1.02 below the lowest point of the yoke in the meter. The yoke between the arms on which the cups of the meter are suspended would be resting on the ground and the vane of the meter would be resting on the ground. The distance between the [ground], the plane at the bottom of the weighting rod and the bottom of the cup of the meter is .32 of a foot. In making the measurements set forth in the twenty one of data on Exhibit 123, I used the rod all the time.

Exhibit 129 received in evidence.

Exhibit 129 is my cross section area of determination No. 1 The maximum six tenths velocity was found at the point 2.2 di tance from the initial point which was on the right bank. I foun the velocity at another place but I used the one at the .20 depth That figure "A" is a full sized cross section of the stream whe I measured it and from the data obtained from that measuremen I worked out the data of No. 13 upon Exhibit 123.

Exhibit 132 is a correct profile of the meter and the horizont top below the circle represents the bottom of the yoke. I simpl took the pin out of the weighting rod and pulled it up again the yoke of the meter. The water was clear. I could see what was doing. I just shoved her down until the center of the cu was .12 of a foot from the top of the stream. That is one tenth a foot and a fraction over. I gauged it by my eye. I knew th meter cups were .18 feet. Half of that is .09; it was [nefessary] f me to put the top of the meter .03 down from the top of the wate It is very easy for a man to estimate .03 of a foot. I could not d that without crowding into the sand. The wheels were not crowde into the sand. The yoke was; the wheels were free to mov

212 I put on Exhibit 129 the profile of the cups of the meter the three points I measured. Eight of the ten differen tenths of the stream was covered by the face of the cups.

I know that the greatest velocity of a stream is found in th upper two fifths of the stream. The velocity I was taking there in cluded many other velocities, the highest velocity of the strean The strongest current of the stream was within my cup and yet figure that that is but 85 per cent of the velocity of the flow on tenth below the surface, if it was one tenth below the surface—th is what I figure in Exhibit 123 and by so doing I get a velocity o .38 at a foot faster in a second than the actual velocity which determined for the swiftest thread of the stream within my mete

In my table I show an error of computed flow compared wit metered flow of plus 16.7. If you take 80 per cent of the maximum velocity I measured which is 1.04 you would have .83 and if yo treat that as the surface velocity, then the error would be minu a small amount instead of plus.

I can explain how I justify putting a meter into a stream an have that meter receive eight tenths the depth of the stream an then put on 15 per cent in addition to the maximum flow (velocity shown by the meter to arrive at the surface flow (velocity) and fo making a deduction from that and putting it in a table of thi character to demonstrate any problem.

For the case under consideration I have drawn a picture whic is a vertical velocity curve, although on an immense scale, th distance from here to here represents only two tenths of a foot The scale in this direction is immaterial because as long as it fo lows that of the average vertical velocty curve, this curve is gen erally drawn in the manner of the average vertical velocity curv Now, in the case under consideration, the meter occupied eigh tenths of the total depth of the stream, leaving two tenths of th depth of the stream which was not included in the area touchin

the meter cups. Now then, you will notice there is one tenth of this quantity not touched by the meter which was at the surface and the balance was at the bottom. Practically speaking, this one tenth of the curve cancels that one tenth of the curve and we are concerned only then with this part of the curve, the eight tenths of the curve. Now, from the very fact illustrated in this manner, that is the face of the meter cups, all the velocities observed in eight tenths of the stream at that point struck into the meter cup
213 when they strike into the meter cup they resolve themselves into an average velocity; therefore, the average velocity of the stream was obtained because the section above the meter which was not obtained and the section below the meter practically cancel out, leaving us concerned only with eight tenths of the total curve. Now, referring to the fact whether I was justified or not in taking the mean velocity and dividing it by .85 to get the surface velocity; the books state—Hoyt & Grover on page 58 states and shows that the top velocity is .85 of the—no, the velocity times .85 will equal the mean velocity of the stream; he does not say .85; he gives coefficients ranging in that vicinity of .85 and from this range of coefficients shown in this book I deduce that it is proper to take the coefficient .85.

It is on this statement Hoyt & Grover that I take my authority for dividing the mean velocity by .85 to obtain the surface velocity. It is upon this statement that eight tenths of the total depth of water that was in contact with the meter, one tenth was above and one tenth was below which cancel; it is upon this statement that this eight tenths is a mean velocity that I base my right to make the deduction that it is proper to take the mean velocity, divide it by .85 to obtain the surface velocity, that is all.

Hoyt & Grover do not say anything about a curve of a stream that is two tenths of a foot in depth. I have assumed to read Hoyt & Grover the 85 per cent in reference to something that they say nothing about, streams that they do not treat of at all and apply it here. That is the basis of Exhibit 123.

Where eight tenths of the depth of the stream is taken into the cups, that the velocity shown equals the maximum velocity at six tenths depth of the stream, has never been discussed in any text book that I know of. This is the first time to my knowledge that anything of this kind has ever been advanced as a matter of technical truth, and it rests upon me and not upon any authority whatever.

I do not know whether or not as a general rule the deeper a stream is within reasonable limits and the wider it is within reasonable limits, the less the percentage of error is in comparing one factor with another and developing one factor from another. I do not care to venture an opinion upon it. There is a general indication upon my Exhibit 123 that the deeper the stream is the greater the percentage of error shown in relation to the eight
214 tenths measurement, with but two exceptions. I do not care to express myself as to whether or not the general rule is that where the width is comparatively great and the stream has an

appreciable depth, the less the factor of error. My Exhibit 123 practically unanimously shows that the wider the stream is the greater the factor of error when the depth is considered at the same time. I do not care to express an opinion upon the question of whether or not as a general rule the deeper a stream is of the same character, the less the probability of error and the less the value of error made in measurements and deductions therefrom.

Referring to Exhibit 130. The highest red line is marked "Surface" at the right. There there is a red line below. The vertical distance between those two lines is two inches. There is the second red line from the top, excluding the top line. The distance between the second red line and the third line is two inches and there follows consecutively red lines so that upon the exhibit there are eleven of those red lines and there are ten spaces between those lines and each one of those spaces is two inches. So then, from the top line to the bottom line is twenty inches and that twenty inches is divided into ten equal parts. If the top be assumed to be the surface of water flowing in a stream or conduit, six tenths of the depth of that water would be six tenths of the total distance from the surface of the stream. That would be twelve inches. I have marked in blue pencil a cross six tenths depth from water surface. I have placed that mark at the same place that there is marked in red .6. I am satisfied that the position marked No. 2 is the proper position to hold the meter in making a six tenths measurement. Holding the meter at No. 2 you would have twelve inches of water above the center of the cup and eleven inches above the top of the cup.

According to the coefficient I have evolved and adopted in making Exhibit 123 for the highest velocity I found at the six tenths depth, with a meter at the position indicated as No. 2, if I found the velocity there to be .85 of a foot the velocity at the surface would be one foot per second. With the meter in the same position and under the same conditions, if I found the maximum velocity at that point to be 1.70 feet per second, the surface velocity by my system would be two feet. If I found the maximum velocity at that point to be 2.55 feet per second, the surface velocity would be three feet. In that case the cups of the meter exposed to the filaments of the water would occupy one tenth of the depth of the water-filament of current.

215 The diagram, Exhibit 131, has been divided into ten spaces, indicated by green lines. This example, No. 1 on Exhibit 123, where the depth of the channel was four tenths of a foot and where I stated that I took a measurement and found the maximum velocity of the horizontal axis of my measurement at six tenths depth of the stream, is apparently all right and properly divided into tenths. Dividing the depth of the stream at my point of measurement, which was four tenths of a foot, into ten equal spaces, each space would be actually one-half inch. My meter would occupy four of the tenths of the depth of the stream and each tenth of the stream would be four one-hundredths of a foot, so there would be four spaces of four one-hundredths of a foot above the top of my meter which would be 1.92 of an inch. Now, assuming my

meter is placed as shown on Exhibit 131 with its horizontal axis six tenths of the depth from the surface, and with 1.92 inches depth of water above the top of the cups, if I found by my meter measurement the highest velocity at that depth in the stream to be .85 of a foot, by my percentage used in the preparation of Exhibit 133, the surface velocity would be one foot per second, and if with my meter in exactly the same position and the same depth, I found the velocity to be 1.70 feet the surface velocity by my computation would be 2 feet and if in that same stream with my meter in the same position I found the highest velocity there to be 2.55 feet per second, my surface velocity by my equation used in the preparation of Exhibit 123 would be three feet per second.

Referring to Exhibit 129. As to that I stated that I found the maximum velocity, when I placed the horizontal axis of my meter at six tenths depth of the water, and there was a little less than three-eighths of an inch of water above the top of the cup of the meter, and the horizontal axis of the meter was then practically one and one-half inches below the surface. According to the basic principle upon which Exhibit 123 is founded, if I found at that point a maximum velocity of .85 of a foot per second, the surface [velocit*h*] should be one foot per second. If at that point, under the same conditions, I found the velocity to be 1.70 feet per second, the surface velocity according to the theory on which Exhibit 123 is made should be two feet per second, and if I found the velocity there to be 2.55 feet per second upon the basis on which Exhibit 123 is made, the surface velocity would be three feet per second.

If my assumption is correct, and there is any basis to Exhibit 123, where the horizontal axis of my meter is [place-] at
216 six tenths depth of the stream, the depth of water above the meter has nothing to do with the velocity of the surface flow.
I go on record as an engineer to the effect that where the horizontal axis of the meter is placed at six tenths depth, actual depth of the waters of the stream, that the depth or height of the water above that horizontal axis, whether it be eleven inches or three-eighths of an inch or any other height has absolutely no influence whatever upon the maximum velocity of the surface flow. I make that record.

The meter runs clockwise. As you face the same way the meter faces it turns to the right and when you are using it for the purpose of measuring water, the cups are up-stream and the vans down-stream. The usual procedure is to stand behind the meter holding the cups up-stream and facing up-stream yourself. The cups are open to the water flow on the right hand side. To be absolutely correct, on a stream of minute section such as I have described, we should always put the meter with the center of the cup over the measuring point.

Exhibit 128 is a cross section made by me of Example No. 13 of my Exhibit 123. When I laid this section off, the zero end of the tape was on the right hand side of the stream looking upstream. It is not my custom to lay it off on the right hand side of the stream and work towards the left.

The point is not in my memory whether in this particular case the initial point was on the left bank of the stream. I cannot recall it. I am satisfied that nothing [woul-] refresh my recollection on it. Just for illustration purposes I assumed that the zero point was on the right hand side when I laid off the diagram. Now, facing up-stream in order for the water to strike the right hand side of the meter at the center of the cups, at the point 2.2 feet from the initial point on the right hand side at two tenths depth, the center of the cups would be on the vertical at 2.2 and if it was taken in that way I have absolutely shown the profile of the meter contrary to what it was. I have marked on there what it would be under those conditions with a black pencil.

If the initial point was on the right hand side according to the drawing, my cups could not have been in the position I speak of without scraping out the sand. If necessary the sand would have been scraped out. It is a detail connected with a measurement which a man would automatically do and never give a thought to. If it was that way I scraped out the sand so as to get the
217 meter down so it would be in the water and then computed that the surface velocity at that point was .85 of the surface of that stream.

Redirect examination:

When I took the measurements of this stream which are represented on Exhibit 129 I could not have taken measurements of the velocity if the bottom of the stream or the banks had interfered with the revolutions of my meter. They did not interfere when the measurements were made.

It is not a matter of practice for the purpose of obtaining records for the Power Company with which I am connected to ever take measurements by means of a float because they would consider measurements made in that manner as mere approximations. The engineering profession consider it only as a rough approximate method.

In working out the co-efficients for the examples shown on Exhibit 123, nine of the twenty-one examples fall within the table of the pamphlet which I referred to in my direct evidence, one of those nine is a co-efficient worked out from No. 12 which was a rating flume, a conduit of that kind would more nearly approximate the conditions under which the co-efficients of the table in the pamphlet referred to was obtained. One of those co-efficients also appears in an artificial channel, No. 13 West Bench canal. It would also approximate to some extent the channel or channels from which these co-efficients in the table referred to had been deduced. The measurements Nos. 2, 3, 4, and 4-*a* are all taken at approximately the same point, namely, at the Mountain Lake road crossing. In working out the co-efficients I find that 2, 3 and 4-*a* are within the table and 4 is without the table. Measurements 5, 6, 7 and 8 were taken at three different times at the same place, 25 feet above the Mountain Lake crossing. Of these four measure-

ments one of the co-efficients I have developed was within the table and the other three are without the table, showing in my judgment that taking measurements at different times at the same place in the stream, you would not get the same co-efficient. One of the co-efficients falling within the table is No. 16. The stream at the point of measurement was rather flat and the stream bed rather smooth, being of rather fine gravel and sand. From that the conclusion can be drawn that the roughness of the bed, or the gradient of the stream, have some influence on these co-efficients. Measurement No. 20, in which the co-efficient falls within the table, is the Provo river, 51 feet in width and with an area of 66 feet.

218 Q. Making it a stream which would approximate with the streams where the measurements were taken from which the co-efficients of the table were developed. You may state whether or not that is so.

Mr. Wedgwood: I object to it as calling for a pure conclusion of the witness and it is not a matter of opinion whatsoever. The data is all in, the evidence, and what this man's opinion is whether that one stream with a dozen measurements or less, or substantially that, in its cross section and that its greatest depth is 2.2 feet, it is not proper for him to give an opinion whether that is substantially the same as a stream whose minimum depth is 1.6 feet, whose maximum depth is 3.6 feet. It is not proper.

The Court: He is an expert witness for the purpose of securing an opinion. His opinion, from your point of view might not be of great value. I will let him answer.

Mr. Wedgwood: Kindly save an exception.

A. Yes, sir.

The Witness: I was asked whether or not I was able to find in any book an actual picture of a vertical velocity curve of a depth of 2.2 inches and I stated no. That is correct as to finding a curve of exactly that depth. There are however, curves of less depth and of greater depth.

My whole conclusion, as stated on Exhibit 123, does not depend on velocity alone. It depends mainly upon the roughness of the stream bed and also upon velocity.

By my answer made on cross-examination that I was unable to find in Hoyt & Grover a statement that by taking the maximum velocity obtained at six tenths depth and applying the co-efficient .85 you would obtain the surface velocity, I intended to convey the impression that literally that thing was not expressed in Hoyt & Grover, but that it is apparent to me from reading a section of Hoyt & Grover that that is true. The language I have in mind is on page 57 of Hoyt & Grover and is, "A study of vertical velocity curves shows that the mean velocity in a vertical equals from 85 to 95 per cent of the surface velocity."

The author has been discussing in a part of his book the distribution velocity in a vertical and is talking about one vertical velocity curve and shows in this discussion that it is an entirely proper

method to obtain velocity at six tenths depth and use it as
219 the mean velocity of the vertical; the mean velocity of the stream for that particular vertical curve from top to bottom, and in my judgment that is a statement that by taking the six tenths depth on a vertical velocity curve and applying the co-efficient .85 you can get the surface velocity at the top of that curve.

Where a float measurement is taken, it is the practice to drop the float in a number of times across the stream and time it and then finally take the highest velocity obtained by the actual flow of the float down the stream instead of the average.

Mr. Wedgwood: I desire to offer in evidence all there is in Hoyt & Grover pertaining to the subject under discussion, I do not care where it is found in the book.

The Court: You do not mean you want it copied into the case?

Mr. Wedgwood: Oh no, but I desire to introduce the book in the record so far as it pertains to this subject for use.

Mr. MacMillan: I am willing this book may be used by either yourself or myself or by the court, either in this court or in the event of an appeal in the Circuit Court of Appeals.

The Court: I have already been reading it.

Mr. Wedgwood: That was the point I am getting at; the book is open for use to all parties.

The Court: Mr. MacMillan has some books in addition.

J. W. ORROCK, a witness produced by the plaintiff, testified in substance as follows:

I have charge of the Snake Creek power station in Snake Creek canyon above Midway and have had since May 15th, 1910. I have kept regular records of the operations of that plant. On those records is recorded from day to day all matters pertaining to the operation of the plant.

I am familiar with the card handed me headed, "Knight Power Company Daily Report" dated December 31st, 1910, marked "Exhibit 134." I remember the incident rereferred to there.

On the back of the card there is a scale upon which certain measurements are made showing the development of electricity in the plant at certain periods of the day.

220 This card was provided by the power company upon which to keep a daily and hourly record of the plant operations. We took a reading every half hour of the kilowatts of the generator; for instance, at midnight it showed that it was carrying 80 kilowatts, and I would put a point down on the card at the line marked 80. Each line represents 20 kilowatts. We took a reading every half hour to determine the amount of electricty that is being generated at that particular half hour, placed a dot on the card at or between the horizontal line to represent the quantity of electricity developed. That is continued throughout the day. Then the dots are joined by a line to form a curve. These are originally put down on a log sheet and then transferred to this card. The letter "A" refers to Generator No. 1, as explained in the legend in the upper left-hand corner.

In making this card, on the face where the form is provided upon which the curve was to be erected, I have correctly and accurately placed a point indicating the measurements of electricity being developed at the various times of day.

Exhibit 134 offered in evidence.

Mr. Wedgwood: I ask that this exhibit be not admit-ed because of its lack of competency. It cannot be competent for any purpose until they have shown how much water it took to develop the maximum peak of power; and furthermore, it cannot be ascertained from that record, what the amount of water was that was being used when the maximum peak of power was developed.

Exhibit admitted.

Mr. Wedgwood: We save an exception.

On the face of Exhibit 134, which is a card for December 31, 1910, I have written "We tried to run both Gen."—that means generators," at once to see if we could not divide the heavy current between them as we have a very heavy current, from 60 to 75 amperes, and for short periods more, which is too much for a 51 ampere generator, but it did not work well as we could not pull so big a load with the water we have. Both Heber City plant and Snake Creek are now loaded to full capacity from 7:30 a. m. to 3:30 p. m." We had a very heavy current as it states there, we thought by running both units and dividing the current would keep the machines cooler. We can get such a current that will burn a machine up; it is the current that makes the machine hot. Mr. Wilson, the Engineer of the company suggested that we put on the two
221 machines to see if we could carry as many kilowatts with the two as we could with one that would divide the current and make them run cool, but we could not carry the load. We could not develop as much power with the two machines as we could with one because we did not have sufficient water. We had only a limited amount of water, and with the water we had we could get more kilowatts out of the one machine than we could out of the two by dividing the water between them. We had in that plant two separate units. The water comes in one common pipe at a certain point, about forty feet from the wheels, and it divides in the shape of a "Y," so that one part may be conveyed to each unit. At the end of the two "Y's," there is a nozzle through which the water passes on to the wheels. We had sufficient water to run one unit, but not sufficient to run two units, because it takes a certain amount of water to bring the speed up before we can develop any power, and by dividing the water of the two machines we were unable to get as much power out of the two as we could get by putting all of the water on the one unit.

Q. Were you using at that time, if you know, all the water that was available at the point of diversion?

Mr. Wedgwood: I object to it if your Honor please as incompetent. This happened in December, 1910 and they produce here certain fixed data and ask to introduce that in evidence, made at the time. There is a place on the exhibit, as referred to this morning for the notation of just that data; "Average water through tail race; average water through creek, C. F. P. S." Now they produce a record which calls for certain data which is not included there. They should not be allowed now to attempt to furnish by oral testimony and recollection what they omitted to put down there. It should be presumed that they had no observation whatever in regard to that from the exhibit itself, and that presumtion ought to be conclusive against them.

Examination.

By Mr. Wedgwood on voir dire:

It was my duty to make these entries upon this card. The card provides a space for certain water data, to-wit: "Average water through tail race;" in another place it provides a space for data in regard to average water through creek. It was not as much my duty to fill out that data as it was the other data, not at that time.

Mr. R. E. Allen was the Manager of our Company. I did just what he instructed me to do. I do not remember whether
222 he said I did not need to fill that out or not; I cannot answer; I do not remember, I followed his instruction. I do not remember the exact words, but I was going according to instruction for the card there. If it is not marked it is because I was not instructed to mark it. I am not an engineer and cannot figure out the second feet of flow.

Mr. Wedgwood: I renew my objection.
The Court: Same ruling.
Mr. Wedgwood: Save an exception.

At this time on December 31, 1910, we were using all the water that was available. It was my business to know whether we were using the water; I made frequent trips to the intake. I knew just the amount we could carry on each machine. It was my business to know I was using all the water; I made that a point to go to the intake and know just how much water we were wasting. During certain parts of the day there was water being wasted down the creek at the time we were endeavoring to distribute the load on to those two units on December 31st and other parts of the day there was not. When we turned the water into the two nozzles we were using all the water.

The cards which are now marked Exhibits 135, 136, 137 and 138 were made by me in the same manner and for the same purpose as I made Exhibit 134 and the explanations I gave on Exhibit 134 as to both sides applies with equal force to these cars that are now marked as exhibits.

Mr. Wedgwood: Of course it is deemed that the objections made to the other exhibits are made to these, of course, and the same ruling.

Mr. MacMillan: The same objection, same ruling, same exception.

The Court: The record may so show.

On Exhibit 135, dated December 2, 1910, I state "Heber City plant cut out at 2 p. m. Something wrong with their water wheels. We could not carry the load and the Little Bell cut out at 2:20 and cut in again at 3:30 after Heber City plant cut in." At this time we were running parallel with the Heber City plant, they were connected at this time, helping us to carry our Park City load. The Little Bell is a mine in Park City to which we were delivering electricity. Something went wrong with the water wheel. They had to cut loose from the load, shutting their plant down, leav-
223 ing the entire load on our plant and we could not carry it; it was too much of a load for us, so we had the Little Bell mine shut down. We could not carry the load because our water pressure went down. We were drawing off more water to supply the wheel [then]was running into the intake. There was not enough water in the creek. We could not carry the load because there was not water enough in the creek. We were using all the water that was available at that time.

The condition that I refer to on the face of the card is reflected by the curve on the back of the card. You will notice on the card at 2 p. m., when the Heber City plant cut out, it showed our load up to 570 kilowat-s, we had been running along about 450 and below. Our usual maximum load would be 440 kilowatts.

When the Heber City plant cut out, we shot up to [*to*] 570 kilowatts, which was more than we could handle; our water went down as a result of trying to hold the load up. When our pipe is partly empty we are losing power, so that drop down to 400 at about 2:30 which causes a sharp peak on the card, and from that point on the load was less during the day.

On Exhibit 136, January 7, 1911, I state "Something went wrong with Heber City plant at 9 p. m. and they cut out, we tried to carry their load, but as our Park City load was extra heavy we had to cut out the Heber City load, but took it again at 12 midnight until 2:30 a. m. while they made repairs; [everyt-ing] O. K." Heber City plant had a load separate from our Park City load; they were supplying Heber, Midway, Charleston with light and perhaps a few little motors. Something went wrong with their plant and they requested that we carry their light load. We tried to do it but it was too much; we had all we could handle with Park City load. We could not handle it because we did not have water enough. We were taking all the water that was avilable at that time.

On Exhibit 137 the card for March 11, 1911, I state, "Heber City plant cut out at 8:30 a. m., the recent rains softened the foundation of their flume and it gave away. We had to cut off most of Silver King load until Daly Judge compressor cut out at 8:30 p. m. Heber City plant cut in at 4 p. m." At this time Heber City plant was

running in parallel with Snake Creek helping us on our Park City load, and as the card states, the foundation gave away of the flume; they had no water; we had to cut out entirely; couldn't help us out any. That throwed too much load on us; we couldn't carry
224 the load. We could not carry this load when the Heber City plant cut out because we did not have sufficient water and we were using all the water that was available. These conditions are reflected on the curve on the back of the card. On Exhibit 138, the card for March 14, 1917, I state, "Heber City plant is running their Governor and we have set our governor to keep all the water on the wheel and they pick up what load we cannot carry, so that they are really doing the governing, the governors work well together only when a heavy load comes on, their governor being more sensitive than ours takes the load before ours can, thus throwing a very heavy load on them for a few seconds." At this time Heber City plant was still at work with us in parallel, helping us with the load. We thought maybe things would work better if we would carry a steady load, carry all the load we could, or all that was necessary, and let them pick up and drop as the loads in Park City varied.

Exhibits Nos. 135, 136, 137 and 138 received in evidence, subject to defendants' objections and exceptions.

I have been continuously in charge of this plant from 1910 down to the present time. I know where the Snake Creek tunnel is located. I remember when water of the Snake Creek tunnel was put in our flume.

As to when the low water period is—the water starts to go down usually about the 15th of June and continues to decrease until sometime in March, very slowly but it gradually decreases in March or April, sometimes it doesn't start to come up until even in April, it depends upon the season. Going back to the period of time covered by these cards, the statement I have just made holds true as to the period from December, 1910, to March 14 and 15th, 1911. There were no sudden changes at that time in the creek, and during the low water period as I have defined it we were continuously operating the two units of that power plant for the years 1916 and 1917, except for a temporary shutdown of one unit for repairs for an hour or two at a time. During this time we got our water supply from Snake Creek Canyon and during those two seasons, which have been particularly called to my attention, commencing with the low water season of 1916, and carrying it into the low water season of 1917, and then commencing with the low water season of 1917, and carrying it over into 1918, we had sufficient water to run the two units continuously.

225 Cross-examination:

The pond or forebay from which the pipe takes the water is about 10,000 feet above the power plant. From this forebay, as it is now, the waters of Lavina Creek, Snake Creek and the Snake tunnel, flow into the pipe. We have two generators, two wheels and two units

at the plant. The generators are rated at 590 kilowatts each, 51.6 ampeers per terminal, each unit. The voltage as the juice comes off is 6,600 volts.

The plant is now hooked up with the entire Utah Powers & Light system. I do not know whether it is hooked up with all their Idaho plants, it is as far as Grace. I could not give you the date it became hooked up but I think maybe in 1911 or the first part of 1912.

In order to personally know what waters are not taken into the pipe line, you would have to go that two miles (10,000 feet) I spoke about from the plant to the forebay, or wait until it (the water) got down to the plant. From the pressure guaged could not tell whether there was half a second foot or ten second feet which was not being taken into the pipe.

R. G. McKAY, a witness produced by the plaintiff, in rebuttal, testified in substance as follows:

I reside at Park City. I am a Mining Engineer by profession and have been engaged in the practice of my profession since 1909. I am now Superintendent of the Daly West Mine located at Park City. Prior to March 1st last I was Engineer of the Judge Mining & Smelting Company. I was engineer for the Snake Creek tunnel from March 1st, 1913, until the tunnel was absorbed by the Judge Mining & Smelting Company, when of course, I continued as Engineer. I am familiar with the so-called Snake Creek drainage area and what is known as Park City drainage area and have been over in the head of Big Cottonwood district a number of times but I am not familiar with the little Cottonwood or the lower stretches of Big Cottonwood. I have prepared a surface map of this district which is now marked Exhibit 139.

Clayton Peak is located in the center of the map marked "A" and also "Clayton Peak, 10,728 feet," which is the elevation. The Park City drainage area is marked "Summit County" and is in the upper center and right hand portion of the map and is outlined by
226 a mountain range extending along the upper part with a
dotted line indicating the outline of Summit County. The area on the right hand portion of the map below this mountain range, and following it down to Clayton Peak, and from there south and southwest to the intersection with Utah County, consists of the upper portion of the Snake Creek drainage area. The western portion of the map marked "Salt Lake County," from the top down to the bottom, clear on the left hand portion southeast of Utah County is the upper Cottonwood drain-ge area. The small area in the southwest corner of the map is within the Little Cottonwood basin.

The Snake Creek tunnel is marked, beginning about six inches from lower right hand corner and extending northwest, by a heavy black line to Clayton Peak. From there there is a turn in the tunnel and it extends about 1,680 feet northeast to the present breast which is the end of the heavy black line. The direction of the compass is indicated by an arrow immediately below the line representing Snake Creek tunnel. The streams are indicated in blue.

Lavina Creek is on the right hand side of the map, the upper portion, indicated by a dotted blue line, which indicates that it is an intermittent stream. From the point marked "7" on, this stream is marked in a full blue line down to where it joins Snake Creek, right in the corner of the map. And the blue line representing Lavina Creek is labeled "Lavina Creek" on the map.

From the lower end of Lavina Creek, or the lower right hand corner of the map, the main channel of Snake Creek extends to the west as far as what is marked. Snake Creek is indicated by a solid blue line and is labeled "Snake Creek." From it there are several dotted branches indicating intermittent streams running down from the heads of the canyons, and the Mountain Lake tunnel is indicated by a heavy black line extending to the northwest over into the Cottonwood drainage district.

This map is drawn to a scale of 400 feet to the inch and is an enlargement of portions of the Park City Special and Cottonwood Special U. S. Geological Survey topographic sheets, heretofore referred to in the evidence in this case. The contour lines are solid brown lines on the portions of the map which are an enlargement of those Government sheets. The contours, indicated in the lower right hand portion of the map and which are not covered by Government sheets, by dotted brown lines and are only approximately right.
Those contour lines show the elevation. Each of the contour
227 lines is labeled in various places along its extent, 9,500 and so
on. This map indicates the portion of the country known as Bonanza Flat in the upper right hand portion and is marked "Bonanza Flat."

O. N. Friendly, a witness produced by the plaintiff in rebuttal, testified in substance as follows:

I am a Mining Engineer by profession. I graduated in 1907 and since then have been doing work in my profession, most of the time in Park City, Utah, as engineer for the Daly West mine, the Ontario, the Little Bell, the Quincy, the Keystone, and the Coalville properties, and the Daly mine. They cover an extensive acreage of ground and were carrying on actual mining operations on a very large scale. I then became chief engineer of the Daly Judge Mining Company and of the Snake Creek Mining and Tunnel Company, and I was chief engineer of the Judge Mining and Smelting Company for about three years or a little over. I then became the general superintendent of the Judge Mining & Smelting Company, also general superintendent of the Mid West Tunnel Company. I have been superintendent of the Judge Mining & Smelting Company for about five and one-half years. All of these companies were engaged in actual mining operations under my direction. In addition to my other duties, on March 1st I became general superintendent of the Daly West Mining Company, which position I still hold.

I have known Snake Creek tunnel since its first inception. The triangulations which were made by me and used by Mr. McKay in making up Exhibit 139 were triangulations which I used in laying

out the original Snake Creek tunnel line, and they run from near the portal of the tunnel on through Brighton and back through Park City and form the basis for all surveys in that entire area. All of them are located on peaks and cover a distance of about ten miles in length. I have measured the streams in the so-called Snake Creek drainage area at various times. I did most of my measuring prior to about four years ago, commencing I believe in 1911. After that I have done some measuring but not so much. I have made a tabulation of my notes, showing the results of my measurements. This tabulation is now handed me and has been marked, "Exhibit 139."

Exhibit 139 received in evidence, as well as a copy of the drawing made by Mr. Wentz on the board of the weir Exhibit 122.

228 The Witness: This tabulation of my measurements is also a tabulation of the measurements made by Mr. McKay. He followed when I stopped taking measurements. Just before the [tabulations] appear there is some data immediately at the top of the page headed "Tunnel flow, early measurements," and the reference Book 1, page 42, Book 2, page 8, etc., are to my field books. The first one shows at what point a small flow of water was struck; 1,700 feet in the tunnel from the portal. The portal is always the datum. Page 8, Book 2, "At 2,780 feet water appears in the bottom of the tunnel about 50 gallons per minute, flows to 1,575 and disappears in fissure." That means that the water came in on the tunnel at the point mentioned and ran out the ditch to within 1,575 feet of the portal and [disappears] and none reached the portal. Book 2, page 15, April 20, 1911, "approximately 2,500 gallons per minute struck in breast at 3,130, work stopped." That is about five second feet. We ceased work at that time until the gas was out of the tunnel and we were able to get in there and the water died down.

Book 2, page 23, "July 30, 1911, delivery equals 2.50 second feet." That means that there was at that date 2.50 second feet of water coming out of the portal of the tunnel.

Book 2, page 25, "August 22, 1911, weir gauge .90 minus 2 equals 5.0 second feet." That means there was [five] second feet of water coming out of the portal that date.

Then follows my tabulation from December 30, 1911 down to August 8th, 1912. I then have a note "tunnel closed down about seven months." The tunnel was closed down because the contractors were in financial trouble and weren't able to continue with their contract. During that time we were doing concrete work on swelling ground. It required concrete to hold it up.

We again started work on the tunnel and I took a measurement of water on June 30, 1913. Following down then to January 30th, 1915 the tabulation shows the measurements that were taken in the tunnel by myself, Mr. McKay and Mr. Taylor. Mr. Taylor was the tunnel Superintendent under me during the driving of the tunnel by the Midvale Tunnel Company, for whom I was General Superintendent.

On February 20, 1915 I have stated here, "Series of measurements inside tunnel, McKay," giving the distance from the portal and the

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results of a series of six measurements. The measurements were made at points from the portal indicated on the tabulation,
229 unless otherwise indicated, and you are to [-ssume] that the measurements were made at the portal of the tunnel.

The measurements then continue showing that they were made by myself, Mr. McKay, Mr. Taylor or Mr. Hunt from that point down to May 22, 1918. That is followed by measurements of Snake Creek above the tunnel, "Tunnel water not included." I mean by that that it is a [measuremen-] of Snake Creek about opposite where the waters from the tunnel enter the channel so that measurement would be the waters of Snake Creek exclusive of the water emptying into Snake Creek below that point from the tunnel, and this point has also been called in this trial "Mountain Lake road crossing." The first measurement of that was on July 8, 1912, showing 11.94 cubic feet per second of water. Either I or Mr. McKay or Mr. Hunt made measurements from there down to May 22, 1918, at which time there was 10.20 cubic feet per second of water in Snake Creek. The tabulation includes all the measurements made by me of Snake Creek above the tunnel at the point indicated, down to and including May 22, 1918. Some of these measurements were made by meter and some of them over a weir. That is followed by measurements of Lavina Creek above the tunnel, tunnel water not included, commencing with July 1st, 1914.

I took measurements of Lavina Creek above the confluence of the waters from the tunnel with Lavina Creek. The point where these measurements were taken are indicated on Exhibit 139 at a point about 100 yards from the mouth of Lavina Creek, I will mark that *a*-1. None of the waters flowing into Lavina Creek from the tunnel were taken in those measurements.

The first measurement appearing on this tabulation is February 2, 1912, showing 3.85 second feet of water, made by me. I continued to make measurements of the creek at that point down to May 22, 1918 at which time I found 4.20 cubic feet of water.

That is followed by miscellaneous measurements. These measurements, without attempting to go into each one of them, are measurements, made at the dates stated in the tabulation in such places as Mountain Lake Tunnel, Mahogony flume at Huber Ranch, Mahogony Spring, Lavina Creek gauge, West Branch ditch above Gerber Spring, Springer Spring flume and a number of other points like that, all of the places being indicated on the tabulation.

Among other things, the tabulation shows the total flow
230 into the canyon on May 19, 1915, having taken a measurement at the main channel, Gerber Spring, Mohogony Spring, power house spillway and Springer's, that would give the total, but that was McKay's measurement.

On the last page of Exhibit 140, miscellaneous measurements of various streams are given.

Q. Mr. Friendly, how did you make your measurements?

Mr. Wedgwood: If your Honor please, I object to how he made his measurements. It is immaterial except in so far as they refer

to the Snake Creek tunnel and any series of measurements which he will say covers and includes the entire flow of Snake Creek above the lowest point of diversion of the Midway Irrigation Company, and I do not understand that he has said that he has made a series of measurements which series taken as a whole include the total amount of water flowing in Snake Creek above the lowest point of diversion of the Midway Irrigation Company. I object to any evidence as to how he made any other measurements, or will when the measurements come in, as immaterial for the reason that it makes no difference what the conditions were relatively or independently of the flow of this stream as a whole at any point above the lowest point of diversion of the Midway Irrigation Company, and it is immaterial what the flow of Snake Creek was except as part of the total measurement above the tunnel at any time; it is immaterial what the flow of Lavina Creek above its junctions with Snake Creek was at any time; it has no individual value in this case nor no relationship value unless it is connected up as a part of a measurement—of a series of measurements that includes all the waters of Snake Creek above the lowest point of diversion of the Midway Irrigation Company, our contention being that whether or not there is less water in any of those tunnels or in Lavina Creek or Snake Creek above the point of diversion is immaterial in the case. The only material question in the case is whether or not we have more water by the amount that is flowing outof the tunnel including all the waters of Snake Cre
that is flowing out of the tunnel including all the waters of Snake Creek the tunnel was driven we had all the waters of Snake Creek which came into it during its entire course above our lowest point of diversion. Not to go into any argument now except to simply indicate our position, and we are entitled to all the waters of Snake Creek up to the extent of our appropriation; it matters not whether they are made up of springs, seeps and underground sources as
231 they were before the tunnel was driven, or whether they are now made up of what is left of Lavina Creek, what is left of Snake Creek and the flow from the tunnel. I make this objection so that it may be understood timely by the court as to what our contention is in that regard.

The Court: I think, assuming the facts shall warrant it, that your contention would be entirely correct, but I think this might or might not be substantive evidence to prove that you were getting all you were entitled to. Can't tell what the proof may show but it might tend to.

Mr. Wedgwood: I don't think it is competent evidence; therefore I make the objection at this time and state the reason for it.

The Court: Of course, as I understand Mr. MacMillan's contention, that he will contend that in any event this water found in the tunnel is seepage water, usually called, he would be entitled to it irrespective of whether you had more or less.

Mr. MacMillan: Yes, that is one. The other contention is, we will attempt to show we have got much more water flowing into that district now because of the tunnel than ever flowed there before.

The Court: Under his seepage theory the measurements would not

make any difference, but if he relies upon the other this might prove it or might not.

Mr. Wedgwood: He appears to be relying upon the other. I think this is immaterial; therefore I made the objection; incompetent.

The Court: I think he has a right to rely upon both. The objection will be overruled.

Mr. Wedgwood: I save an exception.

Mr. MacMillan:

Q. How did you make your measurements?

A. They were all made over a weir or with a current meter, except a half dozen or so of very small streams that we weren't able to have our current meter in. May be one or two exceptions.

The Witness: One of the weirs was in Lavina Creek and for a long time there was one at the tunnel. There was also one in the main channel near the portal of the tunnel.

I have had a dydrograph prepared of a portion of the measurements which are set forth in Exhibit 140, which is marked
232 Exhibit 141. The hydrograph is a graphic illustration, by a curve, of the flow of water through the stream which has been measured. On this particular hydrograph they have two streams represented, the one in black is Snake Creek above the tunnel, and the other, in red, is Lavina Creek above the confluence.

The measurements of Snake Creek were made near the point barked "B-1", in blue, in the lower right hand corner, of Exhibit 139, practically opposite the portal of the tunnel and is at a point above where the water from the tunnel enters Snake Creek. Lavina Creek was measured at the point above the confluence with Snake Creek and before any waters of the tunnel comes into either of those creeks. The years during which the measurements represented by the hydrograph were taken are indicated by the figures at the bottom of the map, on the bottom margin, running from 1911 consecutively up to and including 1918. The various months of those years are represented by the name of the month written practically immediately above the years so that by taking either one or both of those creeks on any month during any of those years and by looking immediately above and following the vertical lines above to the point where the red or black line crosses, you can ascertain the flow at that point, or on that date, in the particular creek. The horizontal lines represent the portions of second feet. The figures in the vertical column to the left of the map running from 2 up to 24, and marked along the figures "second feet", would indicate by following out the particular line where those figures are represented, the number of second feet flowing. The horizontal spaces are divided into tenths making each of them equal to two tenths of a second foot. The vertical lines representing the months are divided five to the month so that if you desired to ascertain the flow of the water to the middle of January, 1912, you would go to January appearing between 12 and 13, and follow the vertical line up to the point where it is intersected by the

two red and black lines. You would add those two together and in this particular instance the flow would be 7.6 and this explanation holds good for the balance of the hydrograph. This particular hydrograph does not in any respect include the water from the tunnel.

The letter "F" indicates that the measurements were made by myself; the letter "M" by Mr. McKay. Those are only marked in the early portion of the map. Each little circle found in either black or red lines represents the exact date when the measurement was made.

233 In the legent it is said "The portion of Snake Creek in outline in 1911 and 1912"—that is from these two points, "represents the quantity of water flowing over a weir at the intake to the pipe line, less the quantity flowing from the Snake Creek tunnel, as shown by the tunnel hydrograph." At one time there was a weir in place in the early years of the [tunnsl] driving, and that weir took the tunnel water, but in drawing the hydrograph we took off the tunnel water and only just showed the balance. That only applies in the first year. It probably does not represent the full flow of Snake Creek because the weir was not in very good condition, some of the water leaked through. After that time we had a very fine form of concrete weir and made very accurate measurements.

Q. Now Mr. Friendly step to this hydrograph and explain if you can the cause of the peaks which are shown on the curve.

Voir dire examination.

Mr. Wedgwood:

I have a measurement in July, 1913. The next measurement I have is in December. The practice is to interpolate between the points. So far as the hydrograph shows it is possible, but [high-] improbable, that there might be a very different condition from what is [catually] shown upon the hydrograph between these lines. I did not say there was no variation whatever from the graceful curve between the two points. From December until May of the next year I show a gradual rise until I reach the peak. The water might come up or down as the period of low water ends. In other words, making a hydrograph covering, as this does, six or seven years, if you had one measurement a year and ran the line connecting the points by an easy, graceful curve, it would look entirely different from what that does, and the more measurements you have between the different times the nearer the hydrograph graphically expresses the rise and fall of the water.

Mr. Wedgwood: If your Honor please, I object to the introduction of this hydrograph, Exhibit 141, unless counsel will say that he will produce measurements of water flowing in Snake Creek upon these dates above the last point of diversion of the defendants, upon the ground it is immaterial and irrelevant what the particular flow of water was in Lavina Creek or Snake Creek at the point he has designated, that is, substantially opposite the mouth of the tunnel. The

question in issue is what quantity of water was there in Snake
234 Creek available for the use of the defendants during the
irrigation season, and this hydrograph does not prove or tend to prove that fact.

The Court: The exhibit will be received and the weight that will be given to it will depend finally upon what the other evidence may show.

Mr. Wedgwood: Kindly save an exception.

A. The peaks or high points coming once a year represent the flood waters in the creeks, and the low water season is represented by the lower portion of the curves in the winter months. The early measurements shown upon the hydrograph by the untinted portion on the right hand and the darker portion on the left hand, were made by the Knight Power people, covering a period of time until June, 1912.

I have prepared a hydrograph of Mountain Lake tunnel which has been marked "Exhibit 142." It shows all the measurements which have been introduced of the Mountain Lake tunnel. This hydrograph is to be read exactly in the same way, and it is constructed in the same way, as Exhibit 141. The broken red line represents measurements which have been introduced; some made by Orrock, some by Deming and some by Barzee.

I have now produced a hydrograph which has been marked "Plaintiff's Exhibit 143." At the top it is stated to be a hydrograph of measurements made by Captain Springer in 1907 and 1908. It represents in the same manner as the other hydrograph the flows obtained by Captain Springer over the Murdock weir during these months, the only difference being that 2.6 second feet is taken from each of the measurements which the Captain found. I mean subtracted. The reason for that is that it was not desired to represent the flow of Snake Creek plus Lavina Creek similar to that shown on Exhibit 141. The measurements taken by Captain Springer were taken below the Springer spring so the water in that spring which flows about 2.6 is taken away from the measurements so as to bring the measurements on the same basis that Exhibit 141 is on. So in fact, Exhibit 143 is the measurement of the combined flow of Snake Creek and Lavina Creek, so that by comparing this hydrograph 143 with 141 you must compare the measurements made by Captain Springer during the time that he made his measurements with measurements made during a similar period of the years represented on Exhibit 141.

235 I heard the testimony of Captain Springer, and have examined his note books and know how his measurements were taken. If the measurements taken by Captain Springer, as testified to by him, and the records which were made by him are sufficient for an engineer to determine the quantity of water flowing in the stream where he was making his measurements, provided he correctly recorded the measurements read by him when he made his observations, it was not necessary for him to make any other observations than those he actually did make.

I have prepared a hydrograph of the water flowing from the Snake Creek tunnel. It is marked "Exhibit 144." This hydrograph represents the amount of water flowing out of the tunnel since it was first started. The vertical line represents the second feet at any date. The horizontal line is marked off according to the dates, one heavy vertical line is marked off according to the dates, one heavy vertical space representing the two months. Also in the blue is represented the number of feet the tunnel was flowing in on the dates indicated. On the left hand side you will find a column reading from the bottom, one second foot upward to the top 24 second feet, so that the horizontal lines which pass across this map represent the divisions of flow in second feet.

Commencing from the left-hand side you have a point marked, "Work began May 1st, 1910." Next immediately over that is a heavy vertical line. Two inches from that to the right is another vertical line and every two and one-half inches on this map you have similar heavy vertical lines and those represent the first day of the month indicated at the bottom of those lines.

That portion in solid blue represents the relative amount of water coming out of the tunnel at any date indicated in that space, so that by looking at the hydrograph you would know from the time the work began until you reached a point between March and May 1st, 1911, that no water was running out of the portal. By horizontal lines which cut across the solid blue space to the left and getting there the number of second feet, you can determine at any particular time while the tunnel was being constructed, how much water was flowing out at the portal of the tunnel. These measurements were taken by weir or meter in every case.

Immediately above the lowest horizontal line, the figures placed vertically over the line represent the distance that the tunnel
236 was in from the portal as indicated on the exhibit, so that by referring to this hydrograph you can determine instantly the length of the tunnel at any given time.

There were times when the tunnel was closed down entirely extending over a period of months. The last work was done the 1st of April, 1915. The tunnel is now 14,500 feet from the portal. I have written on the hydrograph, "April 1st, 1916, work*ed* ceased here." The solid blue space from that point to the right shows the measurements of water flowing out at the portal of the tunnel since the work ceased at the present face of the tunnel.

The little circles on the heavy vertical lines that form the upper border of the space tinted in solid blue show the date of the measurements.

I have prepared a chart showing the precipitation at Heber from December 1st to July 1st during the years 1909 to and including 1917. Exhibit 145 is the chart I refer to. It represents the amount of water falling at Heber as shown by the Government records between the months of December 1st to July 1st of the year, indicated on the left-hand side. The reason these months are taken is to show the amount of waterfall during the winter season. In order to read this chart you must give attention to the scale in inches at

the bottom. The precipitation during the period is represented in inches by the portion tinted in solid yellow, opposite the year indicated on the left and by following out the end of that solid yellow tinted portion and then down to the horizontal line on the bottom, or scale, you can ascertain the fall in inches in precipitation during the months from December 1st to July 1st of any particular year at Heber City.

I have prepared a chart showing a comparison of measurements of flow of Mahogony Springs which have been introduced in evidence. It is marked "Plaintiff's Exhibit 146" and represents the comparison of flow in Mahogony Springs during the summer months of the years 1907, 1910, 1914, 1915, 1916 and 1917. It also shows by whom the measurement was made. The top one is labeled "Estimate by O. J. Call, September 15, 1907." That means that he was not able to measure it and estimated how much there was there. The next one, 1910, Barzee, August 25th (float). He measured that with a willow twig. The other measurements were taken with current meter. The lower line is a scale in scond feet, and you will apply this scale to the yellow tinted portion above exactly as I explained must be done in the former chart showing the pre-
237 cipitation at Heber. The measurement for 1907 and 1910
should not be given the same weight in my opinion as the measurement represented by the solid yellow tinted portion for the other years, that of 1907 being a mere estimate and that of 1910 a float measurement. The point marked "Mahogony Springs" on the right-hand side of Exhibit 121 is where the measurements of Mahogony Springs were taken, that is the point where the waters of the springs flow into Snake Creek.

In August, 1914, there was from eight and one-half to nine second feet flowing out of the Snake Creek tunnel; in June, 1915, 17 second feet; in August, 1916, 19 second feet.

I have prepared a similar chart for the purpose of showing the comparative discharge of Snake Creek and Lavina Creek for a period of years, excluding the water from Snake Creek tunnel. It is marked "Plaintiff's Exhibit 147." It shows the comparative discharge of the two streams on the first day of September of the years indicated on the left-hand margin. The Snake Creek tunnel water is not included. The measurements were taken in 1900 over a weir by Mr. Brooks and all of the balance were taken by our own engineers over either weir or with current meters or a combination of both, and the chart says, "all others from hydrograph;" that would be Hydrograph 141. This chart must be read exactly in the same manner as the others, by reference to the scale at the bottom which is in inches. One inch equals one-half second foot, whereas in the other case one inch equals one second foot.

I have prepared a chart in similar manner showing the comparison of the combined flow of Snake Creek, Lavina Creek and the Snake Creek tunnel on the first day of July for certain years. It is marked "Exhibit 148."

The measurements for the year 1910 are float measurements and estimates by Call and Barzee; those for 1911 are over weirs by our

engineers and by Mr. Orrocks. The balance of the chart is taken from hydrographs already introduced in evidence. As explanation of the chart—the light colored yellow tint in each instance represents Snake Creek; the heavier yellow tint Lavina Creek; the heavy vertical lines represent the year and show the division point between Snake Creek and Lavina Creek or between Lavina Creek and the tunnel. The flow of water is represented by a solid blue tinting. The scale of the map is found at the bottom and represents the number of second feet flowing at any period of time, and is one inch to the second foot, so that by selecting any year on the chart
238 and following down to the scale at the bottom you can determine the number of second feet that were flowing on the 1st day of July for that year, or by taking the scale, and scaling the divisions such as Snake Creek or Lavina Creek or the tunnel, or by counting your divisions which are divided by vertical lines into inches, you can determine the flow on the 1st day of July in those particular divisions, and by comparing the blue tinted portion with the yellow tinted portion you can determine how much water was flowing out of the tunnel, how much through Snake Creek and how much through Lavina Creek, except the first year when the tunnel had no water flowing through it. The yellow tinted partion is represented principally by the hydrograph 141, and the blue is represented by the hydrograph marked "Exhibit 144." This exhibit refers only to the first day of July of each year.

I have prepared a hydrograph showing a measurement of the flow of Mountain Lake tunnel in 1907, made by Mr. W. B. Searle and a comparison of measurements made by O. J. Call which is marked "Exhibit 149." This exhibit shows the measurements of Searle, a civil engineer, who had a weir in this tunnel and took a large number of measurements. The black curve on the exhibit is constructed from his measurements as they appear in the transcript of the evidence in the case of Mountain Lake Mining Company vs. Midway Irrigation Company, and extends from August to December. I have imposed upon that curve another curve representing the measurements made by O. J. Call during that time by float, it is shown by a red line down to the weir measurements of like date. The result of the comparison is to show that at the Mountain Lake tunnel portal the float measurement was approximately forty-five per cent higher than the weir measurement of Mr. Searle, so that by this particular hydrograph No. 149 we have a graphic representation of the result of a weir measurement compared with float measurement taken at the same time, at the same place, by Mr. Call.

Exhibits 139, 140, 141, 142, 143, 144, 145, 146, 147, 148 and 149 received in evidence.

Explaining the flow, as shown, in Mahogony Spring on Exhibit 146, and at the same time referring to the flow of water from the Snake Creek tunnel as shown by the tunnel hydrograph. In the year 1914 on the 19th day of August there was in the Snake Creek tunnel 8.50 second feet; in Mahogony Spring eight second feet; June 26, 1915, the tunnel delivered 17 second feet, and Mahogony
239 Spring 6.75 second feet, so that between 1914 and 1915 the

flow of water from Snake Creek tunnel increased and the flow of water from Mahogony Spring decreased a little over two second feet. On August 28th, 1916, the Snake Creek tunnel was delivering 19 second feet and Mahogony Spring had increased to 7.25 second feet, so there was an increase of two second feet at the portal of the tunnel and also an increase in Mahogony Spring. On August 6, 1917, the Snake Creek tunnel was flowing approximately 16.5 second feet and Mahogony Spring had increased to 11.5 second feet, so that the water issuing from the tunnel had decreased practically two second feet and the water from the spring increased 4.50 second feet.

On August 15, 1914 Mahogony Spring flowed 7.5 second feet and Snake Creek and Lavina Creek combined flowed a little over 12 second feet. In 1915 Mahogony Spring had decreased 2.25 in the latter part of June. On the 1st of September, the total flow of Snake Creek and Lavina Creek and decreased from the year previous to the amount of five second feet. In the year 1916 on August 28th, Mahogony Spring had increased about .75 of a second foot, Snake Creek and Lavina Creek on the same day had increased during the year about two second feet. In the year 1917, August 6th, Mahogony Spring had increased from the year previous about 4.5 second feet and Snake Creek and Lavina Creek increased during the year ending the 1st of September, 4.5 second feet.

Comparing the flow of water from the Snake Creek tunnel with the flow of Snake Creek and Lavina Creek on the 1st day of September as is shown by Exhibit 147,—on September 1st, 1914, the tunnel was delivering 8.5 second feet; on the year following, September 1st, it was delivering a little over 16 second feet, an increase of eight second feet or thereabouts. During the same year the two streams decreased their flow 3.5 second feet. From the year 1915, September 1st, to 1916, September 1st, the Snake Creek tunnel increased its flow to 19 second feet, making a difference of 2.75 second feet, that is, there was 2.75 second feet added to the flow of Snake Creek tunnel. From the first day of September, 1916 to the same date 1917 the Snake Creek tunnel dropped down to 17.5 second feet, Snake Creek and Lavine Creek increased 4.5 second feet during the same period, so that in some places you have a falling off in the tunnel, and a falling off in Snake Creek and Lavina Creek. In other places you have a falling off in the tunnel and you have an increase in Snake Creek and Lavina Creek.

240 Making a comparison of the precipitation at Heber City from the chart—the winter season of 1915 showed a decrease in precipitation of approximately two and one-half inches. There was also a decrease of a little over two second feet in Mahogony Spring and 3.5 second feet in Snake Creek and Lavina Creek. During the next winter season, the year 1915 and 1916 there was an increase of precipitation of about 1.5 inches and there was an increase in Mahogony Springs of about 1.5 second feet and in Snake Creek and Lavina Creek of about two second feet. During the next winter season, 1917 there was an increase of precipitation of about one inch, and Mahogony Springs showed an increase of

over four second feet and Snake Creek and Lavina Creek an increase of 4.5 second feet.

Take the chart No. 148, and making a comparison of comparative increase or decrease between Snake Creek and Lavina Creek on the one hand and the tunnel on the other,—for the stream flow it runs in just about the same ratio it is higher in 1914 and decreases in 1915 and then increases in 1916 and 1917. In that respect the Exhibit No. 148 compared with the three other exhibits I have just compared. The flow of the tunnel increased from 10 second feet to nearly 17 second feet during the year 1914 to 1915; from the year 1915 to 1916 it increased approximately one second foot. During the years 1916 and 1917 it decreased 2.50 second feet. 1917 shows 2.50 second feet less flowing from the portal of the tunnel on the first day of July, 1916, notwithstanding the flow from Mahogony Springs and the flow in Snake Creek and Lavina Creek largely increased over 1916 and the precipitation at Heber increased over the precipitation of the previous year, 1916.

Cross-examination.

I was the engineer in charge of field work preparatory to the initiation of work on the Snake Creek tunnel. I was the engineer in charge of construction of the tunnel up to February 1, 1914; I was connected with the tunnel until its completion as the General Superintendent of the Midwest Tunnel Company who had the contract.

I did not drive this tunnel to take water out of Snake Creek or out of Lavina Creek. I did not spend any money to take water out of either of those creeks in this tunnel. I knew that a tunnel in Snake Creek was projected two or three months before it was actually started. My hydrograph shows that somebody com-
241 menced to make measurements of Snake Creek about the time we struck a substantial flow of water in the tunnel.

I knew that Midway was located near the mouth of Snake Creek canyon at all of the times I mentioned. I knew it was an agricultural community. I did not look into the matter sufficiently to ascertain that it derived the principal part of its water for irrigation from Snake Creek, I was not concerned in it. As soon as we struck water in substantial quantities I, or somebody, began to make measurements of Snake Creek and later on when the flow amounted to something like five second feet per second I and my assistants began to make measurements of the waters of Snake Creek and Lavina Creek.

So far as I was concerned, it was immaterial whether Midway was there or whether its lands were irrigated or whether it got its water from Snake Creek, I was concerned only with the tunnel. I developed an active interest in the waters of Snake Creek and Lavina Creek very promptly after we struck water in the tunnel.

The highest flow that I or my assistants measured on the Mountain Lake tunnel during the years 1914 to 1918 was 10.8 cubic feet per second. In 1915 the highest measurement for the year was

the middle of July. In the other years the highest measurement was along the latter part of July and the very fore part of August. In the year 1915 we have no measurements from the 10th of July until about the 10th of August. There was somewhere from fifteen to twenty days from the last of July and the first of August that we did not make measurements and I do not know whether it was higher then than it was when we made our last measurements in July and the measurement in August, the high point might have been between those two times. The highest point shown on Exhibit 149, which is Snake Creek, occurs in August. Consistently as to call the measurements actually shown, Mountain Lake tunnel shows a peak flow the last of July or the first of August and its low flow in March, April or May. It has a marked rise and fall with considerable consistency each and every year.

Assuming absolute verity for it, whether or not it was the highest point, the high point in 1907 was 13.3 cubic feet per second as shown by Searle and the highest point in 1917 was 10.8 cubic feet per second and all the other years between 1907 and 1917 that are shown by these hydrographs are lower than 1917, and no one of them exceeds 9.5 second feet, so then from 1907 down to
242 and including 1916 it shows a loss from the Mountain Lake
tunnel, in round numbers, of from three to four cubic feet per second and if we assume that the 13.4 feet shown on Exhibit 149 was high, then there is 2.1 less high flow in 1917 than in 1914. From all of these diagram-atic representations, in so far as surface flow is concerned, we find that 1917 is the large year.

Referring to Exhibit 149, that is the Mountain Lake tunnel, Searles, from October I have a straight line drawn from the horizontal. It is a line showing the last two measurements which were some distance apart. There was one measurement made about the middle of October and one about the middle of December. The line from October to December shows nothing except that it is the [*the*] shortest distance between the two points.

Referring to Exhibit 142, I have no measurement showing a lesser volume than 2.2 cubic feet per second and that in 1915. Subsequent to that date I show a considerable less volume, at least one-half cubic foot per second in different years, but I have no figures there. I show a low point in 1917 but half a foot higher than in 1916 with no figures and I show a low point in 1918 about the same as 1917 with no figures. That situation is simply what I conceive it would be, that is all. From 1915 back I have shown the low point to be substantially the same, 2.1 or 2.2 cubic feet per second by a dotted line in red, they are very approximate, but I have no figures at all; it is simply what I surmise it might have been.

It is true that the lowest line, or those in red, on exhibits 149 and 142, show nothing except what I conceive the situation might have been, but as to those in black, we had a very good reason for doing it in a rough way as shown, although we had no actual data in the lowest point, so regardless of how well founded I think my judgment may be, I have nothing for those points but judgment.

Mahogany Springs lies at the lowest elevation of any points referred to or illustrated by the diagram-atic reperesentations produced by me and introduced in evidence. It lies at the nose of the raise, mountain or hill that separates White Pine Canyon from Snake Creek canyon and it is approximately two and one-half miles below the confluence of Snake Creek and Lavina Creek.

Springer Spring lies half way between Mahogany Springs and the confluence of Snake Creek and Lavina Creek. In my
243 judgment Mahogany Spring comes out substantially 800 feet lower than the [floow] of the Snake Creek tunnel,—in other words there is 800 feet in depth of physical material of some kind between where Mahogany Springs comes out and the flow of the tunnel, if they were vertically one over the other. The spring lies two miles due east of the line of the tunnel.

The departure is two miles if you want to speak technically and about a mile and a half south. Springer Spring is about five or six hundred feet lower than the flow of the tunnel, I should judge. If the tunnel were directly over the spring the spring would be about five hundred feet lower. The spring is about one mile east and one-half mile south of the tunnel. That is also on the slope of the ridge that separates Snake Creek canyon from White Pine canyon.

My Exhibit 148 shows the situation as it existed on the first day of July, assuming the measurements were all made at 12 o'clock, each one as accurate as the other.

The low point of Snake Creek in the year 1917 was the last of April, three second feet; of Lavina Creek about the first of April, 2.7 second feet, there is about a month's difference as to dates of measurements. That is as near as I can get those two creeks together during the low water flow.

My measurement of Snake Creek tunnel April 1st, 1917, was 15.3 second feet. In the latter part of August, 1917 the flow of Snake Creek was 10 second feet; of Lavina Creek 5.6 second feet and of Snake Creek tunnel, 17 second feet. In 1916 the low time was February and March, the flow of Snake Creek was three second feet; of Lavina Creek, about the last of March, four second feet; in February three second feet. At the time Lavina Creek was four second feet Snake Creek tunnel was flowing 18.5 second feet. In the middle of August, 1916 Snake Creek had 6.4 second feet; Lavina Creek 4.7 second feet and the Snake Creek tunnel 18.5 second feet. In the latter part of March, 1915, the flow of Snake Creek was 3.1; Lavina Creek 3.2 and of the Snake Creek tunnel 14.6, but it is a very poor place there, it run straight up at just that date. On September 25th, 1915 the flow of Snake Creek was 4.7; of Lavina Creek 3.3 and of Snake Creek tunnel 17.1 second feet.

Approximately April 30, 1914, was a flood water measurement. Snake Creek was flowing 15 second feet; Lavina Creek 6.3 and the Snake Creek tunnel 9.5 second feet. On September 30th, 1914, Snake Creek, interpolated, will be six second feet, Lavina
244 Creek, interpolated, five second feet and Snake Creek tunnel on the same date will be 10.5 second feet. As to this I have to interpolate as to just what the flow was at that time; I do not

know. In August, 1914, interpolating, Snake Creek had six second feet; Lavina Creek 4.6 and the tunnel 8.4 second feet.

All precipitation that falls on the surface of the ground is either evaporated in the atmosphere; runs off into the surface streams or percolates into the earth. In the case of rain you have an immediate absorption by the earth, or an immediate evaporation. In the case of snow you do not get that, it hangs there until the next spring until it does become water, and then it acts as rain; it is stored up during the winter for surface run off and earth percolation.

There are many rivers in many countries that never have any source of supply from melting snows and that get their flow in the absence of surface runoff from water that sinks into the soil from rain.

I do not mean to be understood that there is no water that sinks into the soil or rocks within the Snake Creek drainage area during the months of August, September, October and November. I know there was water that was in the soil, and ran off on the surface, which became tributary to Snake Creek or Lavina Creek during the years from 1909 to 1917, but whatever that water was I have ignored in my illustrations, expressed [vy] Exhibits 145 and 147, for the reason that a portion of that water would go off at the time it fell, consequently our measurements which take up to the 1st of September on one of those maps would not include it and on the other, the 1st of July, it would not include anything which came after that, so that if that had been taken in on the same year, it would have been worthless.

It is not my conception that the volume of the flow of the streams have entirely a direct relation to the precipitation that falls in December of one year and up to July of the next year as to their flow during that year. A stream does not necessarily rise and fall in any direct proportion in any year prior to a given date, to the precipitation prior to that date, including the month of December of the previous year. I do not say that the precipitation in August, September, October and November has no effect upon the runoff prior to July in the next year. It is a fact that after a certain time of the year, except in streams that have their source of perpetual snow, in this arid region, all the water that makes up the flow of the surface stream is water that has at sometime theretofore
245 fallen on the surface and found its way into the material or mass beneath the surface, and Snake Creek is no exception to any other stream as to its low water flow.

I know that the snow water goes off in the Snake Creek drainage area at sometime from March to July, the time varies. There is a period varying from sometime in March until perhaps along the first of July when the snow is gone every year, and from that time on, until the rains and snows commence in the fall, the total flow of Snake Creek is supplied by water which has fallen on the earth and gone beneath the surface of the earth, practically all of it,—there are a few rain storms, very little rain there during the dry season in the mountain, and that has been true as long as Snake Creek has flowed.

The term "master drainage depression" is a proper term to use. The word "depression" as commonly used in that way would mean a natural depression. The level of the water table or ground water level, is the level of the water under the surface of the earth which as a general rule follows the contour of the earth. I do not mean that you would find water in every place you went down to a given depth, but where there is water there is a water level.

Since work ceased upon the tunnel, a period of a little over two years has elapsed. From about April 1st, 1916 up to the present time (June 1918) there has been no extension of the tunnel; no work done on it and it connects up with no artificial opening whatever. It does not tap any galleries, tunnels, or winzes and it does not join with any artificial workings from outside sources.

There appears to be a rise and fall so far as the volume of water flowing from the tunnel is concerned, in each of those two years. A month prior to the cessation of work in 1916 the volume of water flowing from the tunnel commenced to decrease and it decreased until substantially the first of June and then it rose until along in September; then it commenced its fall and generally speaking fell until the next year in July, then it commenced to rise until it made a peak in September at substantially the same time as in the previous years and since that time the flow has gradually decreased. From September last year until May 28th of this year it has decreased in flow from 18.2 second feet down to 14.2 second feet, substantially four second feet.

In the Snake Creek country they have temperatures as low as five and ten below zero. Until a certain point is reached zero
246 weather or below has a pronounced effect upon the flow of streams of that character in the high regions, when ice is formed over them it has no more effect. If there comes a cold snap that lets up; the lowest point of the flow is practically during that cold snap. When they jump up quickly and come back again that shows a day when there is probably a thaw. When the hydrograph, in a season that we expect extreme cold weather, goes up quickly and then within two or three days down again quickly, and up again quickly, it shows a sudden thaw or a sudden cold spell within limits.

I made a measurement of Mahogany Springs about May 23rd, of this year and found 8.63 flowing, which was 2.8 cubic feet less than I found there in August, 1917. .The hydrograph, Exhibit 144, shows that approximately the peak flow of the tunnel was reached in the early part of the year 1916.

I believe the former trial was had in February and March 1915. I testified in that trial, that prior to the trial, we had a flow for a short time of 30 second feet. That is not shown upon the hydrograph, we were unable to measure it, it lasted but a few hours.

The list made [vy] the Weather Bureau, handed me, shows there was 25.56 inches of precipitation at Park City during the year 1914. I show for the year 1914, for the months I have stated on my Exhibit 145, a precipitation of 12.5, about half the precipitation the Weather Bureau record shows. The Weather Bureau record is for

Park City and Exhibit 145 is for Heber City. The Weather Bureau records for Park City for the two months of December, 1913 and up to the 1st of July, 1914 shows a precipitation of 20.1 inches, and I show upon my plat of precipitation at Heber City 12.6 inches a difference of 7.5, less the months of July 1916 and June 1917 for which there is no record on the Weather Bureau report.

There was 8.75 inches more precipitation at Park City for the year ending July 1st, 1917 than I have shown on the chart, Exhibit 148 for the months included therein. Exhibit 148 shows that during the months commencing December 1st and ending July 1st there was almost exactly the same amount of precipitation at Heber City in 1914 as in 1917, and Exhibit 148 shows that in 1914 Snake Creek and Lavina Creek combined flowed 20 second feet, and in the year 1917, 31.75, and although I show upon my plat 145, precipitation to be the same for the [periof specif-ed], yet I find 11.5 second feet more water flowing in Snake Creek and Lavina Creek in 1917 than in 1914.

247 The paper handed me with figures on represents the figures on my exhibit 148 for the years I have mentioned. Added together and divided by 6 gives the mean flow for those five years. That mean flow is 16.8 as shown by Exhibit 148, the flow for the year 1912 was plus 1.7; for 1913 minus 1.8; for 1914 plus 3.2; for 1915 minus 3.8; for 1916 plus .8 cubic feet per second of the mean flow. The greatest minus departure from the mean is 3.8 and the greatest plus 3.2 second feet, so roughly the variation is about the same distance from the mean.

My exhibits 145 and 148 were made for the purpose of showing the relationship between the precipitation falling from December 1st in one year to July 1st in the next year, for the years given, if there was one. As to whether I prepared these Exhibits to show that because the tunnel was driven into the Snake Creek drainage area that it caused more water to flow in the natural channels of Snake Creek and Lavina Creek, above the tunnel mouth, than flowed there before—my purpose was to show exactly what did flow there and let the court draw its own conclusions as to the respective amounts. It was not my purpose to show by these exhibits that the driving of the tunnel caused more water to flow in the surface channels of Snake Creek and Lavina Creek above the point of the portal of the tunnel. I am not contending that the more tunnels that are driven in there, the more water would flow in the surface channels of Snake Creek and Lavina Creek. I am making no contention at all.

I said I made these two exhibits for the purpose of showing the relation of the surface runoff of Snake Creek and Lavina Creek on July 1st comparatively with the precipitation for the months from December to July of the years shown upon the exhibits, to show a relation if there was one.

Q. And you testified in your judgment that there was a relation and said what it was?

A. There was an influence, I said there was an influence.

Q. Will you kindly tell me what your theory is as to what is shown of such relationship, comparing the year 1914 with the year 1917, when upon Exhibit 145 you have the same amount of precipitation, practically, 12.6 inches, and in 1914 you have a runoff from the first of July at a point opposite the tunnel, including the flow of Lavina and Snake Creek, of 20 and in 1917 flow of 31.8 cubic feet per second.

A. My answer to that is in the year 1917, although the winter precipitation was not excessively high and the annual precip-
248 itation was not excessively high, the water fall came at such a season that it was held in the [mountsins] until the following spring, or in the earth.

Q. Now, referring to your proposed Exhibit 140, I find in here a Springer spring measurement of 1.28; it is on the second to the last page of the exhibit; I take it that is an error Mr. Friendly?

A. No, that is right.

Redirect examination:

I answered Mr. Wedgwood yesterday that Exhibit 149 showed less in the high peaks consistently since 1907. That is correct. The hydrograph 149 covers from the middle of August to the middle of December 1907, and simply the months stated at the bottom of the hydrograph. In making my answer I intended to take in the black portion of the two hydrographs 142 and 149. The flow of the Mountain Lake tunnel as shown by Exhibit 149 is 13.25 second feet. The highest point reached on the hydrograph 142 was in 1917, 10.75 second feet. Work has been carried on in the Mountain Lake tunnel since 1911. It was being carried on during the months covered by Exhibit 149 and 1907.

My reason for answering counsel on cross examination with reference to Exhibit 142, we had a very good reason for showing the low points on the hydrograph even although we had no actual measurements, was because the summary of measurements taken for all three years showed that the year 1915 was uniformly lower than the two following years; consequently in bringing up our low point interpolation the curve was made higher for 1917 and 1918.

We did not prepare a hydrograph for Springer spring because we did not have enough measurements and it would not illustrate anything of interest.

My authority for stating that the measurements in Mountain Lake tunnel were weir measurements is Exhibit 39, being the record in Mountain Lake Mining Company vs. Midway Irrigation Company, and reference being to page 25, at folio 61, in which Mr. Searle stated that he had constructed a weir at the mouth of the tunnel and the entire flow of water passed over it, and that Mr. William Witt took the measurements after the weir was constructed. Further reference will be found at pages 39 and 53 of Exhibit 39.

I testified on cross examination that Mahogony Spring on May 23rd, 1918 showed 8.63 second feet, which was two and a frac-

tion second feet less than in August, 1917, as shown on
249 my hydrograph 146. My explanation for that answer is that a comparison based on a May flow in any year with an August flow is not good, because the high water season in this Mahogony Spring comes later in the year than May. Whatever the conditions were on the surface of the ground during the year 1917, so far as I know, those conditions had no effect upon the flow of water through the Snake Creek tunnel.

Recross-examination:

I stated that Exhibit 148 was made up as of the date of July 1st as to each year. The greatest combined flow of Snake Creek and Lavina Creek in the year 1912, upon any particular day was 25 second feet, that would add 6.5 to my Exhibit 148. In 1913 the greatest combined flow of the two creeks at any particular date was 32 cubic feet per second, that would add 17 cubic feet per second to the flow as shown on my exhibit. In 1914 the greatest flow of the two creeks on any particular day was 30 second feet per second, that would add 10 feet to my exhibit. In 1915 the greatest flow of the two streams at any particular date was 15.75 second feet, that would add 2.75 second feet to my Exhibit 148. In 1916 the highest combined flow was 19.4 second feet, that would add two second feet to my exhibit and the highest combined flow in 1917 was 33 second feet and that would add one and one-half second feet to the amount shown on my exhibit.

That part of hydrograph 142 which embraced the years 1910, 1911, 1912, 1913, and 1914, from August of the first year to July in the last, is made up of six meeasurements showing the peak or highest measurement, and outside of those six there are no other measurements except some made within the first thirty or forty days in 1914 which show the down trend for that month, or two months.

The high flow in Mahogony spring comes later than in the other springs in that vicinity, as shown by measurements, for which reason I do not think comparison of the flow in May is proper with the flow in August when the high season is reached.

G. R. McKay, recalled by plaintiff for further direct examination, testified in substance as follows:

I am familiar with all the hydrograph charts which were introduced during the taking of Mr. Friendly's testimony, and participated in making them. They were duly prepared with reference to the measurements which they reflected.

250 Plaintiff's Exhibits 150 and 151 received in evidence.

I am familiar with Exhibit I prepared by Mr. Wentz and introduced in evidence by the defendants. I am also familiar with the streams represented on that exhibit, those which are perennial and those which are intermittent streams, I have prepared exhibits similar to Exhibit 1 which have been marked Exhibits 153, 154 and 155. So far as the ridge lines are concerned, these maps are copies

of Mr. Wentz's Exhibit No. 1, that is, the ridge lines on all the exhibits correspond. The yellow lines, lines of depression, on Mr. Wentz's map have been changed on these three exhibits, so that the flow of water as shown on the map corresponds with the width of the streams. Exhibit 153 is prepared to show the flow of water on July 1st, 1910. The scale of this map, so far as the water is concerned is one inch in width to 50 second feet of flow.

Snake Creek tunnel is shown on each of these exhibits in the same way as it is on Mr. Wentz's map by a broad white line. In 1910 there was no water coming from Snake Creek tunnel, the only water flowing in the canyon was as shown on Exhibit 153. I have the main channel of Snake Creek, starting at the Mountain Lake tunnel, at the left hand side of the map, about midway between the top and bottom, flowing towards the right and passing under the Snake Creek tunnel down to the point about an inch and a half from the portal of Snake Creek tunnel where it joins Lavina Creek which flows south into Snake Creek. From that point on the main channel of Snake Creek proceeds towards the lower right hand corner on the map and is joined about half way down by Springer Spring which flows south into the main channel. About half of the remaining distance, Gerber Spring flows in from the other side of the creek channel. Still further down, Mahogony Spring joins the main channel and still further White Pine creek is shown. There is a number of smaller streams, several of them are shown in the upper stretches of Snake Creek canyon; also Caribou Springs are shown just south of the point marked "Clayton Peak." Those I am now referring to are shown by as fine a line as I could draw. They do not represent the actual width of the stream because I could not draw a line fine enough. It is just the large ones that represent the actual flow of the stream by the width. Twist Spring, Dugway Spring and another spring are also shown flowing into the main channel from the West.

The same description applies to Exhibit 154, with the addition of a quantity of water, I should judge from the width of
251 this, about 10 second feet flowing into the main channel from the Snake Creek tunnel. This exhibit 154 is drawn to represent the flow of the streams on July 4th, 1914.

Exhibit 155 is drawn to show the flow of the streams on July 1st, 1917, and also the flow of Snake Creek tunnel; all of the water flowing out of the canyon on that date.

The lines in white on the upper portion of these three exhibits represent a portion of the underground workings of the Park City district. The arrows pointing to these workings represent portions of the mine from which water is issuing, the size of the arrow approximates in a general way the size of the stream, that is, there are two sizes of arrows shown; the long, large arrows show a comparatively heavy flow of water; the short small arrows represent a small flow. Anything under one-half second foot is represented by a small arrow, anything above that by a large arrow.

On Exhibit 154 I have four arrows; two large and two small. Additional white underground workings are shown on 154 over those on

153. They represent the advance of the headings during those four years. Exhibit 155 shows additional underground workings over those shown on 154. The rather broad green tinted portions, in the upper part of the map, are large fissure systems which run across the Park City district under Bonanza Flat.

The only underground workings represented on Exhibit 115, which are represented on Exhibits 153 and 155 inclusive, are to the southwest of this arrow; it represents about 1,500 feet in the Anchor tunnel, now the Judge Mining and Smelting Company's shaft, the Anchor mine being the former name of the Daly Judge mine. The portion of the underground workings to which I refer is that portion of the Anchor tunnel leading from the arrow, which I placed in black pencil mark within the parallelogram on Exhibit 115, down to the black similar parallelogram marked "Anchor mine." Maps 153, 154 and 155 show the extension of those workings into the Bonanza Flat country.

The upper fissure, marked "Daly Fissure," the red fissure extending down the parallelogram about one inch below the upper side of the parallelogram, continues on past what is marked the "Anchor Mine" and out under Bonanza Flat, and is shown on Exhibit 155, and is the broad green ribbon-like representation on that exhibit. Apparently the red line farthest to the southwest in the parallelogram on Exhibit 115 is the lower fissure shown on Exhibit 155; I should judge they are the same. This fissure is known as the "Back
252 Vein."

I presume the words "Jones Bonanza Shaft," in the upper half of section 32 near the figures 5—3 on exhibit 115, represents the Jones fissures. It is shown on Exhibit 155 directly south of the "Back Vein." It is the smaller green colored portion within the parallel broken white lines and marked "Jones Fissure" with an arrow pointing to the work which crosses that fissure. Some of the workings underground which are represented on Exhibits 153, 154 and 155 follow along these fissures which I have described.

Q. Do you know whether or not as they follow along those fissures they are receiving water from the fissures?

Mr. Wedgwood: I object to it for the same reason, irrelevant and immaterial.

The Court: Same ruling.

Mr. Wedgwood: Save an exception.

A. Yes, they do receive water, a number of them.

The Witness: As the headings of the underground workings approach and proceed in and under the Bonanza Flat [*f*ountry,] the water increases as [*in*] shown by the arrows on the different maps; in 1910 we had only two headings which were delivering a small amount of water as indicated by the small arrows; in 1914 these headings had been extended out under Bonanza Flat and the one farthest north and one farthest south were receiving a heavy flow of water. The last one referred to had cut the Jones fissure. There were two intermediate flows indicated by small arrows, both on the

1,200 level of the Judge; one of them had extended further to the southwest but it was not on the fissure and the flow had not increased. In 1917 some of these workings had been still further extended to the southwest and had received increased flows as indicated by the two additional heavy arrows, so I put on this map four long arrows indicating heavy flows and one small arrow indicating a small flow. The one small arrow is the same as it was in 1914; the heading has not been advanced.

Q. Through what properties do these fissures run in Park City?

Mr. Edgwood: I object to it as incompetent under any issue in this case shown by the pleadings.

253 The Court: I do not think Mr. MacMillan [*vases*] any claim upon the ownership of this real estate.

Mr. MacMillan: No.

A. The Daly fissure has its northeast extension in the Ontario mine as it was first discovered in the Ontario mine, and followed to the southwest through the Daly and Daly West and the Judge.

The Witness: The Black Vein has not been followed to the northeast past the Daly West mine, that is, it has not yet been found in any mines except the Daly West and the Judge. The Jones fissure has not been located in any mine except the Judge, so far as I know.

On the 15th and 16th of the month (June, 1918), I made a measurement of the flow of the Snake Creek tunnel. The tunnel was flowing 14.48 and Lavina Creek 4.68 second feet.

I have prepared charts showing a comparison of the flow of Provo River, as taken from the tabulation furnished by Mr. Wentz, with the flow of Snake Creek, as measured by Mr. Call, Mr. Barzee and myself, which have been marked "Exhibits 156 and 157." Chart 156 is well explained by the title, "A Comparison of the Relative Flow on various dates of Provo River. The total discharge from the Snake Creek canyon, Provo River data by T. J. Wentz, etc." The Scale of Provo River one-inch equals 200 feet; Snake Creek canyon one inch equals 20 feet. The scale of Provo river is ten times as great as it is in the Snake Creek canyon in order to bring them closer together and make the comparison more nearly correct. The flow of Provo river is represented by green; of Snake Creek by a brick color, and the dates when the flows were ascertained are shown in the left hand column, reading from top to bottom.

Exhibit 157 is constructed exactly in the same way with exception that on 157 I have compared the flow of Provo river with my own meter measurements, whereas in 156 I have compared this flow with measurements made by means of floats by O. J. Call and George Barzee. The quantity in each case as indicated to the right of the square which represents the quantity that is in the first square, on July 17, 1905, there was 274 second feet flowing in the Provo river and 29.32 second feet flowing out of the Snake Creek canyon according to the measurement made by Mr. Call, and the same explanation applies to both charts in each case.

Mr. MacMillan: I offer the exhibits in evidence.

254 Mr. Wedgwood: I object to them both as incompetent as misleading and deceiving to anybody who is not a skilled engineer. They show an apparent condition which does not exist and not a graphic illustration. In order to make anything out of it at all you must compare and compute, and the diagrams apparently contradict the figures; and for the further reason that in order to get any connection there [wo-ld] have to be 365 charts made assuming that you only show the conditions once in a day. In other words, every day will show a different condition.

The Court: We will take the testimony.

Mr. Wedgwood: Kindly save an exception.

The Witness: On Exhibit 157 the variation between Snake Creek and the Provo river is practically identical throughout the chart; the Provo river doesn't extend quite so far to the righ as the Snake Creek does in each case. In Exhibit 156 there is no such regularity about the blocks at all. In 1905 the two blocks for Provo river and Snake Creek canyon are about equal in length, Snake Creek is a little bit longer. July 16, 1906, Snake Creek extends considerably further to the right than the Provo river does. September 3, 1906, the two are closer together and more nearly approximate the relationship shown in Exhibit 157. On July 6, 1907, Provo river extends very nearly three inches and a half further to the right than Snake Creek does. On July 27th, 1907, Snake Creek is longer than the Provo river square. On August 15, 1907, the Snake Creek is considerably longer, nearly twice as long as the Provo river rectangle. On July 2, 1908, the Provo river square extends over twice as far to the right as Snake Creek does. On August 14, 1908, we have about the same relationship we have in Exhibit 157. On July 28th, 1909, however, the Snake Creek square is more than twice as long as the Provo river square. On August 25, 1910, we have more nearly the relationship of Exhibit 157. On July 8, 1913, the Snake Creek square is about twice as long as the Provo river.

In other words, Exhibit 157 shows the flow of Provo river to be proportionate to the flow of Snake Creek, throughout the years 1915 and 1916 whereas Exhibit 156, where Snake Creek is represented by the measurements taken by Mr. Call and Mr. Barzee, does not show the Provo river is proportionate to the flow of Snake Creek.

Mr. Wentz ascertained his figures of the flow of Provo river in the tabulation I used by a compilation of the discharge record from the United States Geological Survey.

255 Cross-examination:

There is no relationship, so far as size is concerned, between the width of the streams as I have drawn them in yellow on Exhibits 153, 154 and 155 and a copy of Exhibit 1. My object in combining those two stranger factors together was to show the relationship of the flow of water at those different times, I did not know any other good way to represent it. The flow as represented on the scale is one inch in width to a flow of 50 cubic feet per second upon a map with a scale of 1,000 feet to the inch.

1914 and 1917 were both comparatively high water years. In 1914 Snake Creek reach a Maximum flow of 19.4 cubic feet per second, about one and one-half second feet higher than in 1917. The data I have on the flow of Snake Creek and Lavina Creek, on July 1st, 1910, is a measurement made by Mr. Barzee.

On Exhibit 157 I have shown the Provo river and Snake Creek each upon a different scale. Provo river is ten times the scale of Snake Creek, this difference in scale exaggerates the comparison, that is the intention. Of course, to the eye, that makes the difference between the two appear to be much greater, than it would if the Provo river extended out 14 inches upon the same scale. It would make it difficult to make a comparison at all if you made them on the same scale. In each of the cases I find by my diagramatic representation that Snake Creek should project further to the right with reference to its scale than the Provo river. Exhibit 156 is upon the same scale exactly, and the same two streams. If the impression produced, which I have just said should be, and would be produced by looking at 157, then on 156, for 1907, Snake Creek should extend considerably beyond the Provo river to the right; in other words Exhibit 157 is not large enough to meet the conditions apparently illustrated by it and the conclusion might be drawn that the flow of Snake Creek as shown on July 6, 1907, of 136.62 cubic feet was in error in being too small instead of an error in being too large, and the same thing is true in regard to 1908, and it produced that condition in several others, that it — very near the same length in 1910, 1906, and 1905, Snake Creek does not extend to the right, in those three years, to the extent that my plat 157 apparently shows that it should in order to be consistent with 157.

If I had used the same scale for Provo River as I used for Snake Creek, it might extend Provo river far out beyond the edge
256 of the map and give it ten times the length. I used the same scale for Snake Creek on 157 as I did on 156, so this exaggeration that was referred to in counsel's question on cross-examination really cuts no figure in these exhibits, but by using these different scales I am able to make a better comparison. You can see the comparison, better if one was ten times the length.

H. L. Stone, recalled by plaintiff for further direct examination, testified in substance as follows:

In company with Mr. McKay, Mr. Wentz, and Mr. Tanner on last Saturday, June 15th, I went to the Snake Creek drainage area and made measurements for the purpose of determining the accuracy of float measurements.

In my opinion, Exhibit 1 introduced by Mr. Wentz does not depict the facts in the flow of water in that area, as compared with meter measurements and weir measurements.

Exhibit 158 is a tabulation showing the results of my calculations from the experiments which I made in connection with those gentlemen on that date. The tabulation down to the horizontal line refers to Lavina Creek; the first column headed "Condition" describes the

condition of the banks and the bottom; the next heading Section considered" refers to that part of the 30 feet through which the rest of the computations were found. I have chosen to call the upper cord station zero and the middle cord, which is 12 feet distant, Station 12; the average of these two is assumed will give the average area of the section from Zero to 12. The next column, "Velocity of fastest float" is in feet per second. The figures 3.0 represent the fastest float, of six floats, that went over that section. The next column shows the discharge as it would be computed in cubic feet per second by the float measurement which we were comparing. Explaining the equation 2.24 x 3.00 x .8 equals 5.37. The 2.24 is the area from the second column to the left; the 3.00 is the velocity of the fastest float taken from the next adjacent column on the left, and the .8 is the coefficient which according to the rule is to be applied for determining the true discharge of the stream from the average area and the surface velocity. The next column is the discharge in cubic feet per second as measured over the concrete weir, which was about 400 feet below where these float measurements were taken, and the discharge over this weir is taken in the tabulations as the true discharge. The next column "difference in cubic feet per second" is the difference between the discharge by the float method and by the weir. That shows an excess by the float method
257 of .69 cubic feet per second. The next column shows the error in the float measurement by percentages, and the mathematical calculation to be made gives the equation .69 over 4.68 equals plus 14.7 per cent.

In this first section from station zero to 12 I found a discharge by the float method of 5.37 cubic feet per second; [bu-] the weir of 4.68 per second, a plus error in the float measurement of 14.7 per cent. By plus I mean that the float measurement result exceeded the true discharge as measured by the weir. From station 12 to 30 I give a plus error of 162.6 per cent. The last one in that experiment is from station zero to 30 which covers the two sections previously considered and gives a percentage of error in the float measurement of plus 39.2.

The next series of measurements and results of those experiments are shown in the succeeding three lines of figures. On station from zero to 12 we got a percentage of error on float measurement of plus 14.5; on the station from 12 to 30 a percentage of error on float measurement of plus 65.8 per cent; on station from zero to 30, or the combination of the two former sections, a percentage of error of plus 36.1 with respect to the float measurement.

The result of the experiments made upon Snake Creek are shown on Exhibit 158 in the last set of figures on the exhibit. We took two equal sections of 10 feet each; an upper and a lower section, a combined section of 20 feet. We used 10 floats.

On our upper section from station zero to 10 the result showed an error in float measurement of plus 29.2 per cent over the current meter measurement; on our station from zero to 20 an error in the float measuement of plus 32.2 per cent, and upon section from 10 to 30 an error in float measurement over the meter measurement of plus 48 per cent.

On the next day Mr. McKay and I made additional experiments n the Mound ditch. Exhibit 159 shows the results of these experinents. They were performed in substantially the same manner as have explained, as the experiments shown in the tabulation marked 58. I took a section of 15 feet for the upper sections and 20 feet or the lower, making a total of 35 feet. We used six floats and took the fastest. For our section from zero to 15 we got an error
258 in the float measurement over the current meter measurement of plus 46.5 per cent; on the section from 15 to 35 an rror of plus 42.2 per cent. On the total section an error of plus 18.5 per cent in the float measurement. We used 14 floats and took he fastest.

I have the filed notes and computations made in the office on these xperiments. They consist of 15 sheets marked Exhibit 160.

Exhibit 160 received in evidence.

Office notes above referred to, 27 sheets marked "Exhibit 161" eceived in evidence.

Exhibits 162, 163, 164, 165 and 166 handed me are photographs aken at the time of the experiments showing the sections of the tream over which the experiments were taken.

Exhibit 162 is Lavina Creek and shows the condition of the stream after we had cleaned out the section. Exhibit 163 is a picture of Lavina Creek after we had cleaned out the section, showing Mr. Wentz in the picture, the white lines across the stream represent the strings we used to divide it into sections. Exhibit 165 is the section of Lavina Creek before clearing out the rocks. Exhibit 164 is a section on Snake Creek, showing the condition of the stream after we had cleared the sides of the stream of water cress. Mr. Tanner is in the picture standing in the stream and it shows the two sections; three strings.

Exhibit 166 is a section of the Mound ditch after we cut the sod from along the bank.

Exhibits 158, 159, 160, 161, 162, 163, 164, 165, and 166 received in evidence.

I made a test to ascertain whether or not the method pursued by me in my former calculations by using the coefficient 85 per cent to arrive at the surface velocity was or was not a correct method. For the purpose of measuring the true discharge of Snake Creek a current meter measurement was made. This measurement was made by five tenths method where the stream was less than nine tenths in depth and six tenths method where it was more than nine tenths in depth. The observed velocity at the six tenths depth at this point was 3.42 feet per second. I divided this velocity by .85 which was identical with the method pursued on Exhibit 123 and obtained the surface velocity of the stream, a velocity of 4.02 per cent. The maximum float velocity through the section zero to 20 was 4 feet per second.

259 On the Mound ditch we also made a current meter measurement by the six tenths depth method. We used the coefficient .85 and applied the same method as stated for Snake Creek, the velocity obtained by the coefficient was 2.67, the fastest float from zero to 35, and had a velocity of 3.18.

The Court: Just at this time I would like to say in look- over Hoyt the other day that if I understood the author he did not recommend float measurements being made after the manner that these seem to have been made. If I misunderstood the author——

General Wedgwood: There is no question about that.

The Court: The author seems to indicate a number of floats should be timed in different parts of the stream and a mean taken.

General Wedgwood: I brought that out.

Mr. MacMillan: And we drew it out from our witness. The whole question is it wasn't done that way by Mr. Call; he endeavored each time to drop it in the fastest part of the stream, then took the fastest measurement. We have pursued that because those are the figures we are called upon to meet in this case, and we [calim] those float measurements were not properly taken, that he didn't pursue the proper method.

Cross-examination:

I saw Mr. Wentz handle the meter in Lavina Creek. The entire party was there. I kept the notes for Mr. Wentz, but I have not computed the notes into flow.

Recess for ten minutes while witness makes the computation.

The Witness: According to the readings and the cross section taken there, the measurement shows a flow of 3.71 second feet. The weir readings show a flow of 4.68 second feet. In other [wrods], the weir reading showed that there was .97 of a cubic foot per second more water flowing than the meter measurement shows. Again, in other words, the meter measurement was 80 per cent of the weir [measur-ment]. In order to have the meter measurement come up the weir measurement to be 80 per cent of the total flow.

In my direct examination I stated that a meter measurement was correct and gave the correct result in all such channels. I still say so if the meter measurement is correctly made. You under-
260 stand me to say that the only deduction that can be drawn is that this measurement was not correctly made.

I have checked over the computations and I took the notes correctly. I am clear and conclusive that in streams of that character meter measurements as I have described, give a correct measurement within limits of about five per cent, which may be plus or minus. The only way I can account for a 15 per cent error in this case over my five per cent is that Mr. Wentz's measurement is wrong, but I do not accuse Mr. Wentz of any wrong doing. Mr. Wentz did the stream work in both cases, that is, in Lavina Creek and Snake Creek. He was checked on Snake Creek however, by Mr. McKay. I do not believe Mr. Wentz would give an intentional wrong reading, but it is highly probable that unless there was a mistake in the reading, or intentional wrong reading, such a result as is shown here would have been impossible. It is not impossible then, in a stream of this character, that the error between meter and weir measurements may be 20 per cent if Mr. Wentz gave the correct reading.

The cross section we took in Snake Creek for one of my illustrations at station zero was 10.09 square feet. I have three stretches of the stream. The last cross section is 8.22 square feet.

I stated in my testimony yesterday on direct examination that in my opinion all measurements made made with a float, taking the greatest velocity at the .8 basis, would be high. I did not attempt to define high. In substance I said that in my judgment float measurements by the maximum float velocity of .8 basis would be absolutely unreliable and always too high. That was the idea I intended to convey.

Now on Snake Creek, on the 15th, the low cross section area was 8.22. By the meter measurement and my calculations, I found 21.83 cubic feet per second flowing. Assuming that the cross section area of Snake Creek, in the same field where I worked on the 15th of this month, was 8.86 square feet and the measurement was taken by a float, I would not say that a result of 16.35 cubic feet per second was excessive. It is .64 of a foot less cross section area than I had and the flow was 5.48 cubic feet per second less than what I got.

Mr. Wedgwood: In connection with this cross examination I offer the following entry from Mr. Call's book on page 107, the second entry.

261 Mr. MacMillan: Aren't those all in already?

Mr. Wedgwood: Yes, but I want to put it into the record.

Mr. MacMillan: All of Call's books are in.

Mr. Wedgwood: Yes. Exhibit 19 "Main channel of Snake Creek in Bishop Coulsom's field near lane, 11 a. m. cloudy and cool; L. 18 feet; T. 7.8 Sec. Wd. 7.64 feet F. 1.16 feet cross Sect. 8.86 Sq. Ft. flow 20.44 second feet less 20 per cent 4.09; correct flow 16.35."

Q. There is a record which shows in comparison with your measurements on the 15th that the result obtained was 5.48 cubic feet per second less than what you obtained with a greater cross section area, is it not?

A. Yes.

The Witness: There has been placed upon the board a diagram showing dimensions 0 to 10, 10 to 20. That corresponds with our determination on Snake Creek. We [*tool*] three cross sections of the stream. The cross section area for the float measurement was 8.22 square feet. My notes show that the cross section area taken for the meter measurement was 7.91 square feet. In other words, a cross section for the float measurement was taken at a certain place and we got an area of 8.22 and when a cross section area for the meter measurement was taken at exactly the same place we got a cross section areas of 7.91 but I did not take either one. The cross section area was .31 of a square foot less for the meter measurement than it was for the float measurement at exactly the same cross section.

The cross section area at station 12 of the measurement [*u*] on La-

vina Creek was 1.73 square feet. The cross section area where meter measurement was made was 1.3 square feet, so that the cross section area when the meter measurement was taken was .43 of a square foot less than it was for the float measurement at the same point and the cross section as applied to the float, after figuring it out, is substantially 25 per cent greater than as applied to the meter measurement.

Mr. Springer was there when the measurement of Lavina Creek was taken at the place shown by Exhibit 165. Mr. Springer states that that was not at all the character of a channel that Mr. Call had when he made his measurement when he was with him. I heard him say that once, but there is doubt in my mind whether I heard him say it more than once.

262 If a meter measurement had been made at the Lavina Creek location where the second measurement was made at zero, at station 12 and at station 30, the three meter measurements should have shown the same results. They probably would have been alike within a small percentage of difference. I would not like to give a judgment as to what percentage of difference would be. In my opinion, if a meter measurement had been taken of Snake Creek at station 10 and station 20 under the conditions as we met them up there that day, if we had made three measurements instead of one, at each of the different stations, I think the flow would have been the same. There might have been a slight error. It might run up to 10 per cent; if carefully made, it should not run up over five per cent.

On Snake Creek we took ten float determinations. They were all considered in making up the final result. The fastest float to each section was used as a factor in making up the final result. There was a string across the stream at station zero and when the float went under the string the watch was started and the party that held the watch went down to station 10 and took the time there and then went through to station 20. There were four men engaged in timing, each with stop watches. We had two float observations which gave the same lapse of time, each of them gave five seconds. That is what I used in determining the float velocity over the distance, 0 to 20. We had but one float that showed the same velocity from 0 to 10. That was 2.6 seconds. I determined the velocity from station 10 to station 20 indirectly; by subtracting 2.9 from 5.

The mean velocity of the meter measurement of Lavina Creek was 2.86 feet per second. To get the flow of the stream you multiply the cross section by the mean velocity. The area of the cross section at station 12 that was used by the float measurement is 1.73 square feet, and multiplying the velocity by 2.86 would give 4.95 cubic feet per second. The cross section area at section 30 was 1.53. Multiplying the cross section area by the mean velocity will show a flow of 4.37 second feet.

The area of the station zero on Snake Creek was 10.09 and the mean velocity shown by the meter was 2.76, that would give a discharge of 27.9. The area that I used for float measurement at station 10 was 8.22, which multiplied by 2.76, the mean velocity

of the meter, would give a discharge of 22.6. The cross section area at station 20 was 8.76. Multiplied by the mean velocity
263 of the meter 2.76 equals a discharge of 24.2. The discharge as I reported it on Exhibit 158 by meter measurements is 21.83 and the discharge in the three items of float measurements as I worked it out, and as we have gone over it in the cross-eexamination, was 28.22, 28.86 and 32.33. 32.33 is where I got at the lapse of time of the float for the second 10 feet by the process I have told you of, using next to the highest time of the float over the first ten feet.

Referring again to Lavina Creek. We found the cross section where Mr. Wentz made the meter measurement to be 1.30 square feet. The velocity as shown by the meter is 2.86 feet per second. The discharge as shown by the velocity of the meter and the cross section area where the velocity was taken was 3.71. The weir showed a flow of 4.68 second feet and respectively the float showed 5.36, 7.76 and 6.37 second feet. Assuming that the flow of the stream in cubic feet per second is as shown by the weir, 4.68 cubic feet per second, and assuming that the cross section area is 1.30 square feet as taken at the time and place of the meter measurement and taking that cross section and the 4.68 cubic feet per second as the flow both as factors would show that the mean velocity was 3.6 per second. Applying that velocity to the cross section area at zero the flow would be 5.25, applying the same velocity to the cross section area at station 12 which is 1.73 and the flow would be 6.24. Applying the same velocity per second to the cross section area at station 30 of 1.53 and we have a flow of 5.51 second feet.

Referring to the figures made by counsel on the blackboard on cross-examination, I will state that none of the methods pursued in arriving at the figures on the board is correct because counsel attempted to take a mean velocity obtained from one section and apply it to other sections.

From station zero to station 10, I took two sections, that would be one at zero and one at 10, and I determined the area of the creek from station zero to station 10 by averaging those two areas, but that has not been done in a single instance by General Wedgwood on his question on cross-examination, and you cannot get a correct result by the float method without averaging it.

The Court:

Q. Can you expect to get a correct result with just two?

A. That is the big trouble with float measurement, getting enough areas.

Q. Isn't that the main question for the purpose of determining with accuracy?

264 A. That is one of the things that is hard in making float measurement is getting the true average area.

In arriving at the area from station zero to station 20, I average the three areas, that is, the one taken at zero, one at 10, and one at 20, in order to get the area throughout the entire section. That

method was not pursued by counsel on cross-examination in arriving at the figures on the board, so that the figures on the board do not represent anything than a result of multiplying the combination of figures, and they would not aid me or any other engineer in drawing any conclusion as to the quantity of water that was flowing over this section in Snake Creek by the float method or any other method.

During the cross-examination, counsel placed on the board the equation, 4.68 over 1.30 equals M. V. The M. V. stands for mean velocity; and 4.68 represents the discharge in cubic feet per second over the weir; and 1.30 represents the square feet in the cross section of Mr. Wentz's meter measurements. In determining the mean velocity from the observation made at the weir, the di-charge as measured should be determined by the cross section of the weir channel above the weir crest. This method was not pursued in the formula stated on the board, and the equation, therefore, would give no result that would amount to anything.

Neither Mr. Tanner nor Mr. Wentz proposed to take any measurements or make any changes or make any experiments which either Mr. McKay or I refused to do at the time the four of us were making our experiments. The four of us agreed upon the procedure which was finally followed, and after we made the experiments neither Mr. Wentz nor Mr. Tanner proposed that any additional experiments be made. In cleaning out the stream, Mr. McKay, Mr. Wentz and I proceeded at Lavina Creek, and at Snake Creek Mr. Tanner also got into the stream. After the stream was cleaned out, neither Mr. Tanner nor Mr. Wentz proposed that any other change be made in the stream. After we cleaned out the stream, we waited from 15 to 20 minutes before we began our measurements. The rocks that were in the stream were about six or seven feet below the lowest cord when we took our first measurements in Lavina Creek below station 30. No objection was made by Mr. Wentz or Mr. Tanner to our moving these rocks; nor did they propose after we took the measurements that the rocks should be thrown back into the stream.

Referring again to the first example on Lavina Creek—the
265 mean cross sectional area for the section considered as zero to
12 was 1.64 square feet. This multiplied by the velocity of flow as shown by the meter, 2.86 feet per second would give a flow of 4.70 second feet. That comes within .02 of the weir measurement. Now taking the cross section area 1.64 square feet and 3.60 as the velocity of the flow as factors, that would give a discharge of 5.90 second feet.

The mean area of the section zero to 10 on Snake Creek is 9.16 and the mean velocity as shown by the meter was 2.76. With those figures as factors the discharge would be 25.3. The average cross section area between stations zero and 20 was 9.02. Multiplying that area by the velocity 2.76 gives 24.9 as the discharge. The mean cross sectional area from 10 to 20 was 8.49 square feet. Multiplying that by the velocity of 2.76 and the discharge is shown to be 23.4 cubic feet per second.

The cross section area that we did use with the meter measurement was 7.91. Multiplying that by the velocity 2.76 is a discharge of

21.83 second feet, that is what I call the meter measurement. That cross section (7.91 square feet) was taken in the same identical place as the cross section 8.22, in the float measurement.

The cross section taken for float purposes on Lavina Creek was 1.73 square feet and cross section taken at the same place for the meter measurement was 1.30 square feet. So that where I got my greatest float measurement the cross section area taken as 1.73 was at identically the point where the cross section area used for the meter was taken as 1.30 square feet.

The 1.73 is the area in square feet for station 12 as measured before the float measurement was made and the area of 1.3 second feet are figures of the cross section at the same place the current meter measurements were made by Mr. Wentz a little later; that is the area he obtained.

On Snake Creek Mr. McKay made the soundings which produced the figures 8.22 square feet. He was checked by Mr. Wentz from the bank. Mr. Wentz at the time of the current meter measurements made soundings which have developed a cross sectional area of 7.91.

I used without question or protest the cross section of 7.91 which gave me a discharge of 21.83 to develop apparent errors of float measurements in this case, whereas if I had used 8.22 it would give me a larger discharge and a smaller factor of error to the extent of about four per cent. During the time that this cross section-
266 ing was done Mr. Wentz protested repeatedly at the way it was being done and the depths that were being obtained.

Referring to the manner in which the depths were taken, I think instead of Mr. Wentz saying that it was more in the nature of a banter, that the ultimate result was that we agreed upon the measurements that were taken jointly. When I answered counsel's question, that Mr. Wentz objected, I meant that Mr. McKay would read one figure and Mr. Wentz another, and then they would agree upon the figure.

Redirect examination:

I stated that it was harder to make a float section than a current meter section. The reason is that for the current meter sections you have only to determine one area accurately—that is, your meter enables you to get the velocity at a particular spot, or a particular plane in the cross section, only one cross section is necessary because the velocity is taken in one plane across the stream. In the float system you have to get the velocity of the stream from its travel and its rate of travel is determined in a way by the cross section; therefore, it is essential in making float measurements that you have the absolute average cross sectional area for the entire length of the stream through which the float travels, and for any results at all this means a distance of at least 10 or 12 feet, and it means you must clean out this much of the stream to as uniform and true a section as possible. Then it means to get a true section that you must make an indefinite number of cross sections up and down through that entire 12 feet.

Recross-examination:

Referring to my exhibit 158, my first determination consists of [fo-r] experiments. The top one refers to a section of Lavina Creek from zero to 12 as expressed in the figures as to error determination. It was based on actual measurements of time elapsed as to the flow. Now referring to the lower one of the four from station zero to 30. That factor of error is also derived from actual measurement of the time of float. The two between the first and the last—that is, the two from section 12 to 30 were derived from the use of velocities obtained between zero and 12 and zero and 30 as factors. I selected the factors to use in determining the time of the float. Those two determinations from 12 to 30 show by far the greater factor of error than the other two.

Referring to the second determination which is also Lavina
Creek. The time of the float from zero to 12 is determined by
267 measurement of time. The time of the float from 0 to 30
was determined by measurement of time. The time of the float from 12 to 30 was determined by taking two measurements of time selected by me as factors and the section from 12 to 30 upon my determination of time shows the greater error. Taking the third determination. This is on Snake Creek on the same exhibit. The time of the float from station zero to 10 was measured. The time of the float from zero to 20 was measured. The time of the float from 10 to 20 was determined, and was determined from factors selected by me, and that section from 10 to 20 based on factors determined by me shows the greater error.

So, in each one of the three cases, wherever I determine the factor of time of the float, by far the greater error is shown.

Redirect examination:

The manner of taking the time of these sections was agreed upon by the four of us. No other method was proposed by Mr. Tanner or Mr. Wentz. [The-] participated in the taking of the time.

Exhibits 167 and 152 received in evidence, to be read into the record at any time.

Recross-examination:

Neither Mr. Tanner nor Mr. Wentz had anything to do with the selection of the factors used, and derived, in the determinations referred to in Exhibit 158. I did that all myself.

Mr. MacMillan: I find that I was mistaken in these exhibits 152 and 167. They were two separate sheets shown to me treating two different subjects, and I thought without looking at this curve these were the two separate sheets; I find they have all been put into one sheet so we have a duplication. With consent I will withdraw Exhibit 167 and allow 152 to stand.

Captain STRINGER, recalled by the paintiff for further direct examination, testified in substance as follows:

I went to Snake Creek on June 15th, in company with Mr. Tanner, Mr. Wentz, Mr. Stoner and Mr. McKay to make certain experiments there. I watched them clean out the streams. I said to them that the bottom of the canyon was a good deal rougher than when Mr. Call and I measured it; that the channel had changed. After they had cleaned it out I thought the lower section looked very favorable. The upper did not look good. I thought it was
268 rougher than the section Mr. Call and I took; rougher water and more fall.

Cross-examination:

When they were working, referring to the character of the stream, I said, they had a job on their hands to make it as good as Mr. Call had it. Taking it as a whole it was not as good as Mr. Call had, to the best of my remembrance.

G. R. McKAY, recalled by the plaintiff for further direct examination, testified in substance as follows:

I have produced a map entitled "Park City and Alta Mining District," now marked "Exhibit 168". Since the former trial I have had it colored to show the various districts surrounding Clayton Peak. It shows the tunnel of the Snake Creek Mining Company in a heavy black line, in the lower side of the map, leading northwesterly across the Bogan group and Rochester group to the Clayton Peak which is shown by a sort of a bull's eye on the map, from there it proceeds northeasterly for a short distance.

The Park City mining district lies over the hill from the Snake Creek drainage area northerly, shown on this map in the green tinted portion. The Big Cottonwood mining district which lies westerly of Clayton Peak is shown in pink tinted portion; Little Cottonwood mining district below that in blue tinted portion and Bonanza Flat is outlined on the map in the yellow tinted portion; the upper portion would be Bonanza Flat. The northern boundary of Bonanza Flat is the range of mountains practically parallel to that dividing Snake Creek area from the Park City area. That portion tinted in yellow, off to the southeast of Bonanza Flat country, over which the word "Wasatch" is written is what is known as the White Pine drainage system. The outline in the light brown color includes the Snake Creek drainage area to the west, so that by taking the light brown color and the yellow color you have the Snake Creek drainage area so far as it is shown on this map. Lying still westerly the brick colored portion represents the American Fork mining district.

Q. Mining claims which cover the various districts, the Park City district, the Bonanza Flat country, the Big *B*ottonwood district, Little Cottonwood Mining District, the American Fork mining district, the Mountain Lake Mining Company are shown upon this map, are they not?

269 Mr. Wedgwood: I object to it as incompetent, immaterial and irrelevant under any issue joined in this case. What mining claims are within the Snake Creek district is immaterial and incompetent under any issue joined; likewise as to each of the other mining districts, the extent, area, possession, ownership or the fact that they exist at all is immaterial, irrelevant and incompetent under any issue joined in this case. This is a wider objection and goes to a different proposition entirely from that made to the underground openings artificially made in mining. It takes in another question altogether.

Mr. MacMillan: What is the other question it takes in that your former objection did not take in?

Mr. Wedgwood: There are no pleadings which make the ownership or location or size of mining claims material, relevant or competent. Under the pleadings, the issues joined by the pleadings, it is absolutely incompetent and [absolutel-] immaterial and irrelevant as to who owns mining claims or what the extent of the mining claims are, or what their position upon the surface of the ground or to the depths is, and it being immaterial and irrelevant under the pleadings, evidence to show what they are, where they are, who owns them, and their size and extent is incompetent.

The Court: If I understand, you are offering this testimony as descriptive rather than as—doesn't purport to prove title ?

Mr. MacMillan: I [don'-] propose to prove title to this—I may with another witness and [*ahsll*] attempt with another witness to show that this tunnel was driven as I told counsel when he was cross-examining our witness, for the purpose of developing the Daly Judge [p*or*perty] and draining it, transportation tunnel to the property Jesse Knight, and that it was the intention after they reached a point near Clayton Peak to branch off, go into the Daly Judge country to the northeasterly, southeasterly into the Jesse Knight property and the Great Western. That comes later on. Mr. Friendly will testify to that. At the present time this is simply descriptive and also for the purpose of showing—I will lead up to it—that surrounding Clayton Peak on all sides mining is being prosecuted in the Park City district, the Bonanza Flat country already in evidence, it is presumed in the Bogan group, the Mountain Lake country and the Little Cottonwood country, the American Fork country, the Big Cottonwood country, and that Clayton Peak stands as a sort of center around which all these mining districts are located, and that the driving forward of the works in these
270 various mining districts tends to drain this entire country around Clayton Peak.

Mr. Wedgwood: Now, if the court please, all that is competent under the pleadings can be introduced and illustrated without showing the location of the different mining claims and what their boundaries are. To admit this is to put into the record a situation very graphically and which upon its face would be proof, in the absence of contradiction, of the ownership and location of particular mining claims.

Mr. MacMillan: How can that affect you in any way at all? Suppose I do prove ownership of every one of them, how could it affect you?

Mr. Wedgewood: Well, I don't think under the pleadings it could affect but it is immaterial and therefore an exhibit which tends to mislead, tends to show that a certain thing or when a certain thing is evidence, and it depicts certain things, the impression is at once that was put in for a purpose material and relevant to the case, and if this is allowed to go in then the record has got to show so far as the question of the particular surface boundaries of each claim, who they belong to, just where they are located with reference to the tunnel.

Mr. MacMillan: I don't propose to ask that question.

Mr. Wedgwood: I say the exhibit shows so itself; it imports verity.

Mr. MacMillan: I am asking the witness whether or not it does show it.

The Court: If we had a jury here trying this case to a jury, there might be some force that the jury might be misled into weighing it. I hardly think any court, either this court or the appellate court would be influenced by any graphical showing unless they were misled in some respect to what the fact was. I understand your theory to be that you have a right to develop your property and for that purpose this map will show, with the testimony, that the tunnel was run for that purpose.

Mr. MacMillan: That is one of the purposes of this map, so it may be pointed out on the map.

The Court: That is, it is available for the purpose, and I think counsel has a right to try the case upon that theory so this court or any other will finally decide that is a proper theory as matter of law.

271 Mr. Wedgwood: Will your Honor save me an exception. And will your Honor also grant me leave at this time to later on move to strike this exhibit from the record.

The Court: Certainly.

Mr. Wedgwood: I don't care to go into it now but I think upon the time of argument it will appear why I so strenuously objeect to this exhibit being introduced in evidence.

Mr. MacMillan: I shall object to any motion to strike out an exhibit at the time of argument when I haven't my witness to supply some evidence which counsel might at that time point out has not been supplied.

The Court: If that matter comes up, proper disposition will be made of it to protect both parties.

Mr. Wedgwood: May this objection and ruling and the remarks in relation thereto apply to any questions that may be asked which refer to the ownership or the possession of any particular mining claim from the map as indicating where it is upon the ground?

The Court: That may be understood.

A. Yes.

The Witness: The location of the Daly Judge property is shown upon the map and is indicated by the words "Daly Judge Mining Company". They own six claims in there. They own about 90 per cent of the claims in between the last portion described and the Daly Judge mining claims which are shown over on the Bonanza Flat country.

The Ontario drain tunnel is shown by the black line running from the easterly and northerly part of the map. The scale of the map is 1,000 feet to the inch, the same scale as the map 115. The portion which is colored in light blue on the right hand side, labeled, "Blue Ledge Mining District", is the Blue Ledge Mining District. The data for the mining claims shown upon this map is taken from the Surveyor General's office. Actual mining operations are being carried on in all of the mining districts I have heretofore named. They are being carried on in the general direction of Clayton Peak from all sides.

I have prepared a map entitled "Plan and profile of Snake Creek Tunnel," marked "Plaintiff's Exhibit 169" from my own and Mr. Friendly's surveys. The map is a profile of the surface
272 along the line of the tunnel from the portal to Clayton Peak,
showing the geological formations cut by the tunnel; the line of the surface which would be cut by a vertical plane passed through the tunnel, and also a hydrograph of the water flowing from the Snake Creek tunnel at the time that the tunnel was at various distances in from the portal. The hydrograph referred to is the blue tinted portion starting at about station 3,000 in the tunnel and running then back to the right hand side of the back and having a blue line forming the boundary at the top and immediately over that portion which represents by two parallel lines the data on either side of those lines the line of the tunnel itself.

The outline is a heavy line and bordered by hatched lines following from the left hand side of the map to the upper right hand corner represents the surface cut by a perpendicular plane passing through the tunnel. It shows how the surface would look if you could cut away one-half of the mountain through which the tunnel runs and look at the other half as it stand- there. It gives the elevation. The upper right hand corner of the map would be over station 12,820. The words "Snake Creek Channel" represents the portion of the surface cut by the vertical plane before mentioned, through which Snake Creek channel flows; the channel of Snake Creek as it crosses over the tunnel, proceeding up along the surface the indentation at the top marked "Caribou Gulch" is the point where this plane crosses Caribou Gulch for the first time as it crosses over the surface of the ground immediately above the tunnel. Proceeding again to the right and upwards is another place marked "Caribou Gulch". Caribou Gulch twice crosses on the surface immediately above the line of the tunnel.

Following along the line of the tunnel there is marked over the outline of the tunnel the words "Alluvium" and "glacial drift", "diorite boulders", "quartzite", "diorite", "blue lime", "black lime", "blue and gray lime" and "marble beds". Those refer to the geolog-

ical formations on the surface and such formations as are cut by the tunnel at the points marked by those words.

At various points on the map commencing at the left hand side and going to the right are vertical broken lines marked "800 feet", "1,000 feet," etc. They refer to the *death* of the tunnel beneath the surface at that point.

The parallel lines drawn closely together at various parts of the space between the surface and the tunnel, and which are cut
273 by vertical planes making a block appearance, represent the beds as they would probably appear in the section exposed extending from the tunnel to the surface. The beds as they appear here are principally lime and quartzite and are laid on the map in a general way with reference to the beds which were actually exposed in the tunnel.

When we cut those beds in the tunnel we were able to ascertain their strike and dip and notes were made in our field books of the strike and dip, and those notes influenced me in laying upon this map the representation of the beds or bedding planes lying between the surface and the line of the tunnel itself. To the right of the vertical line marked "2,500 feet" a different formation is shown, it is what is known as the Clayton Peak diorite stock. It is cut into irregular blocks by approximately straight lines which represent the joint planes or shrinkage cracks in the diorite, due to the cooling of the molten mass and shrinkage when it cools, they are cracks of various sizes, usually rather small, in many cases they are open cracks through which water would run. The broken line crossing the tunnel at an angle pitching off to the left represents the contact of the lime and marble beds at the point 10,193 feet. From that point diorite continues as far as the tunnel has been driven. Diorite was first cut at the point where the pink border along the tunnel line joins the green border, and it is at the point where the contour 9,500, on Exhibit 139, crosses the tunnel line. The distance from the point where the diorite contact is first met in the tunnel on a straight line to the face of the tunnel *and* is about 3,650 feet.

On Exhibit 169, commencing at the surface and immediately below the word "Alluvium" just to the right of Snake Creek channel, there is a solid red line following along the bedding planes down to a point almost to the tunnel, that refers to a sill of porphyry which the tunnel cut and which is now covered by the concreted portion of the tunnel. To the right of the end of that solid red line is another portion in solid red, dipping nearly vertical and actually intersecting the line of the tunnel, that refers to another porphyry dike which was cut by the tunnel, it does not go to the surface as shown on the map because we have never found it on the surface. We did not find the other one near the word "Alluvium" on the surface not exactly over the tunnel line, but very close to it. I have projected it to this point on this section 169.

274 To the right of the line, which is almost vertical, marked "Porphyry" is another red line which follows down the direction of the dip of the first line and crosses through and beneath the tunnel at the point marked "Concrete"; that refers to porphyry

which we found at that point, and from the dip, as it was found in the tunnel, it appears to correspond with the one found at the surface, so I assume that these two are really one. Further, and just to the right of the vertical line 1,000 feet and between station 4,000 and 5,000, there is another similar representation in red, cut-ting through the tunnel departing slightly from the vertical, then above that, but not connected with it, another portion in red, the lower one refers to a porphyry dike similar to the other two which were cut by the tunnel; the upper portion is a continuation of this line towards the surface. It was not found directly over the tunnel line on account of the alluvium and boulders which occur at that point, but at a distance of approximately 1,000 feet to the West of the tunnel line it is located on the surface, that is the reason why I do not show it going clear to the surface of the map.

I can point out on Exhibit 139 the places where we actually found porphyry. Going up Lavina Creek we found porphyry just below the point marked "No. 3", indicated by a red dotted line with "Por-phyry" written underneath. Continuing up Lavina Creek, about two inches to the left, at a point marked "4", also indicated by a red dotted line and an arrow pointing to the north marked "82 degrees" indicating the dip of the exposed portion of the porphyry. Fol-lowing the broken contour line which passes approximately to the point last mentioned, continuing to the cross hatched portion of the map we find an outcrop of porphyry at the point where this dotted brown contour line crosses the ridge, it is indicated in the same manner as the others. Following down the ridge is another outcrop of porphyry indicated in the same way. Going to the west we find an outcrop of porphyry almost over the tunnel line about one-half inch to the south, between stations which are marked in red "1,000" and "2,000". Continuing to the west and further up the hill we find another outcrop of porphyry which crosses the black line to the north under which is written "Bonanza Tunnel" the arrow on this dotted red line marked "60 degrees" indicates the dip in that direction.

Referring to Exhibit 169. The vertical scale of the hydrograph is one inch is equal to five second feet. Taking the represen-
275 tation of the line of the tunnel, there are at different points stations marked in red "1,000", "2,000" and so on up to 12,000. These stations are the number of feet from the portal of the tunnel. Each has a brass plug in the side of the tunnel.

The words "wet area"; "most of water is dripping from beds," refers to the time when this geological examination was made in 1914.

Crossing the representation of the line of the tunnel are a number of red lines in various directions. They are fissures in the rock cutting across the beds, openings of various sizes that were actually cut by the tunnel as it was driven. Notes of these were made at the time and its lines were laid on the map from those notes. Below the portion of the map I have now referred to, there is another por-tion of the map marked "plan." On the plan the beddings and fis-sures are indicated as in the section exhibit shown as they would b

f you were looking straight down on the tunnel from above, that is, f the surface of the earth were cut off from the portal clear to the ight and lifted off.

The two parallel lines represent the walls of the tunnel. The blue ines which cross the tunnel represent the strike and dip of the beds. The red lines indicate the fissures. They are the same red lines which are found crossing the tunnel in the section. The difference is, in the upper section you are looking at them from the side and from the lower you are looking down on them from the top.

The small arrows which are shown on the blue lines that cross the plan of the tunnel indicate the direction of the dip of the beds.

Right over station 8000 are the words "beds very irregular, dipping rather steeply to the north." In that portion of the tunnel, as you approach the diorite the beds become massive and rather indistinct and no effort has been made to plot them on the map in detail.

To the right of that I have "metamorphosed lime beds very irregular"; the same explanation would refer to that.

Exhibit 171 would represent a continuation of the section marked "Exhibit 169" if continued in the direction in which it is running; it would represent the continuation of the tunnel in its own direction on to the northwest through Clayton Peak without turning to the right and that would take you into the Big Cottonwood drain-
276 age basin, which is marked on Exhibit 168 by the portion colored in pink, and into the portion that is included in the Daly Judge Mining Company's property. The tunnel has not actually been driven into that part of the country. That merely indicates the surface as is shown.

Exhibit 172 which is headed "Geology Snake Creek tunnel, Wasatch County, Utah; seals one inch equals 50 feet," is an enlargement of the portion of Exhibit 168 in the immediate vicinity of the tunnel. It represents that portion of Exhibit 169 from the portal to the point immediately to the right of the portion marked in black and labeled "Concrete."

This is continued on the second line from the 3,200 feet point to about the 6,500 feet point and on the third line from the 6,400 feet point to about the 9,600 feet point to Clayton Peak. The portions of the enlarged map, Exhibit 172, are exactly like the portions which they duplicate on Exhibit 169. Only in the lower section I have indicated the cracks in the diorite the same as it was indicated in the upper right hand part of Exhibit 169. The contour of the ground as shown on Exhibit 171 and Exhibit 169 is true according to the elevations which I have ascertained from topographic plates of the U. S. Geological Survey, and I ran a survey over that line from the tunnel portal and Clayton Peak to get data to draw this way.

Explaining the difference between Exhibit 144 and 169. Exhibit 144 represents the water coming out of the tunnel at any certain date, that is the squares, two inches and a half apart extending across the map from left to right, indicate a radius of two months. On Exhibits 169 the distance of the upper limit of the hydrograph

above the tunnel represent the quantity of water coming from the portal of the tunnel when the face of the tunnel was directly at the point under this point on the hydrograph, wherever it might be. In other words, Exhibit 169 determines the quantity of water coming from the portal of the tunnel at any number of feet that the tunnel had reached from the portal, while Exhibit 144 gives you data from which you can determine the quantity of water flowing through the portal of the tunnel at any date, whether the tunnel was in operation or not.

On Exhibit 168 I have running through the Park City district extending southwest into the Snake Creek drainage area district, the Bonanza Flat Country,—some red lines, some parallel with others. They indicate the fissure systems and are labeled ["f*u*ssures."]

277 Those are the same fissures, or the extension of the same fissures which are shown on the parallelogram on Exhibit 155 introduced by Mr. Tanner, and indicating the continuation of those fissures in the Park City district into the Bonanza Flat country.

Exhibit 170 is a continuation of Exhibit 169, along the line of the tunnel from Clayton Peak to the northeast; the hydrograph is continued as it is in 169 on the same scale. The end of the hydrograph to the right as it appears in Exhibit 170 represents the face of the tunnel. The scale of the map is the same as 169, one inch to 200 feet.

The word "Divide" on Exhibit 170 indicates the point of the division of the drainage system. To the right the slope is towards the Park City system; to the left towards the Bonanza Flat. The part which is shown as the divide above the ridge would be the point where the tunnel line would continue. It would cross the ridge shown in heavy blue between the Park City district and the Snake Creek drainage area. I have indicated an irregular line following down from the word "Swamp" on Exhibit 170 and marked "probable edge of diorite," mean by that the diorite extends from a point probably about 15 inches from the edge from the right side of Exhibit 169 to the irregular blue line on 170.

The data from which I placed that probable line on the map is taken from the geological map in Park City paper 77, and the lower part is indicated by the extension of the Judge workings.

I have indicated on Exhibit 115, the map presented by Mr. Tanner, the fissures which were shown in red on the parallelogram as they will pass into Bonanza Flat country. They are indicated by red broken lines, the upper being marked "Daily Fissure," below that the "Back Vein" fissure, also in a red broken line, also the Jones fissure by a red line.

I have also laid upon Exhibit 115 the extension of the underground workings from the parallelogram as they passed into the Bonanza Flat country and represented them by the irregular blue pencil lines. There are about six and one-half miles of workings shown in blue on Exhibit 115.

The extension of the Daly Fissure, as I have shown on Exhibit 115, would be about two and one-half miles and the extension of the Back Vein fissure about a mile.

278 Exhibit 173 is a geological section through the mountain on the seals of 400 feet to the inch, the same scale as Exhibit 139, and extending along the line of the Snake Creek tunnel from the portal to Clayton Peak. At that point there is a bend in the section and it extends to the northeast into the Park City Mining District, as I have indicated on Exhibit 168, it would follow from the portal of the tunnel marked "A" to Clayton Peak, then follow the broken red line northeast into the Park City District to the point marked "A" prime—to a point about 1,000 feet beyond the point marked "Ontario No. 3 shaft," to the point where the heavy red line intersects the broken red line.

The heavy black border at the top represents the contour of the surface from the portal of Snake Creek tunnel through Clayton Peak into the Park City Mining District to the point which was marked on Exhibit 168 by the heavy red line crossing the broken red line.

On the left hand side of the rise I have marked "Divide" and "drainage to Snake Creek" and on the other the right hand side, I have marked "drainage to Park City, and immediately below the divide I have dropped a broken blue line through the representations of the various geological conditions and have labeled it "northern limit of Snake Creek drainage basin."

On the left hand side of the map I have some parallel lines with cross lines dividing it into blocks, that indicates the limestone beds through which the tunnel passed and is labeled "limestone beds." The dip is northerly just as in the map 169. These lines are brown.

The red lines which pass from the surface down through the brown lines indicate the extensions of porphyry dikes cut in the tunnel and the red lines which apparently follows the surface along the line of the dip of the bedding planes is what is known as a porphyry sill. This brown colored portion I have described as limestone beds is a representation on this map 173 of the beds which are shown on Exhibit 169 from the portal of the tunnel up to the contact with the diorite and the red lines passing through the limestone beds indicating porphyry are intended to represent the location of the same porphyry represented by heavy red lines in Exhibit 169. Above the limestone beds is a portion colored in yellow up to the contact with the diorite, that represents quartzite beds which appear on the surface at that point. We also have a small amount of quartzite cut
279 by the tunnel itself. There is also a strata of brown running through and practically parallel with the dip of the beds of the quartzite to the surface and label-ed "lime" that indicated a bed of limestone which was encountered in the tunnel next to the diorite.

Passing down from Clayton Peak from the vertical I have a broken line which is marked "bend in section." From that line to the left the direction of the section is south 35 degrees east, from that red line to the right the direction of the section is north 50 degrees east, indicating that the section is not a straight line but a bent line which will be indicated by the two sides of a book opened at approximately 105 degrees, as indicated by the representation which I made on Exhibit 168.

Immediately to the right of the portion representing the diorite in the portion colored yellow, are yellow lines dipping northerly, indicating the lowest formation which we find in the Park City district, known as the Weber quartzite. Immediately above the Weber quartzite, colored brown, is a series of chiefly limestone beds which is known as the Park City formation; it approximates 700 feet in thickness and is the area in which the chief ore bodies of the district are found. Above that I have a portion marked in green and with green lines dipping northerly, marked "Woodside shale," that represents the formation immediately overlying the Park City formation known as the Woodside. Immediately above the Woodside shale I have a heavy broken red line following down to the right and dipping northerly marked "Daly Vein." That represents the intersection of this geological section with the plane of the Daly vein which is one of the main fissure systems of the district. On Exhibit 115 it is indicated by the broken red line extending from the Daly West shaft in the quadrangle drawn by Mr. Tanner and continuing to the southwest, it is also indicated on Exhibit 168 by a heavy red line through the Park City district to the Bonanza Flat country and marked "fissure," and is the upper one of those three fissures.

Above the so-called Daly Vein and immediately below the word "Divide" on the surface, there is a portion tinted in light blue with irregular lines, at the surface at that point there appears a little body of igneous rock which is indicated in blue similar to the diorite. below that and following it along down, the Daly vein is a portion colored in brick and marked "Thayne's" with lines running
280 from the surface down to the Daly vein dipping in a different direction from the lines or bedding planes on the other side of the Daly vein; that indicates the Thayne's formation which immediately overlies the Woodsire. The parallel lines indicate the dip as it is cut by this section.

From the surface to the center of the last described quartzite is a broken red line almost vertical marked "Massachusetts fault." That is one of the large fissures of the district. It is shown on Exhibit 115.

On the left hand side of the map 173 there is a heavy black line commencing immediately at the surface and continuing beyond Clayton Peak into the diorite. That represents the Snake Creek tunnel.

Commencing at the left hand side of the map and running through the various formations almost to the diorite are various horizontal black lines, some of them cut by vertical lines, some from the surface down and others beneath the surface. Those are a portion of the underground workings of the Park City district which are projected into this section; the greater portion of the workings shown on this exhibit are not cut by the section but on Exhibit 168 they lie below the broken lines extending from Clayton Peak to the northeast, a portion of them lie southerly or southeasterly of the section line, and a further portion on the other side of this line; these were all through into the section; the geological formations shown to the left of Daly vein are as they would be in the section

itself. The formations on the right hand side of the Daly vein are projected a short distance, probably 200 or 300 feet and are the formations cut by the Judge tunnel which is the upper black line extending from the surface to the left and labeled "Judge tunnel."

The lower horizontal black line labeled "Ontario drain tunnel" represents the location of the lower Ontario drain tunnel which has its portal over near the Provo river. This tunnel is 600 feet lower than the Snake Creek tunnel. It is intersected by a vertical black line from the surface down and is labeled "Ontario No. 3 shaft." It is a representation of the No. 3 Ontario shaft which I pointed out on Exhibit 168.

As you pass in along the Ontario drain tunnel it meets a vertical black line labeled "Daly West shaft," that is the main working shaft of the Daly West mine. It reaches the surface and it apparently does not on account of being projected from the point where the surface is lower than it is directly over where the shaft is
281 shown upon this map. Passing further to the left of the
Ontario drain tunnel it appears to be connected by representations of raises or winzes, with other workings above it, they are the workings of the Daly West and Judge mines. As we follow up these workings we come to a horizontal line which practically parallels the Ontario drain tunnel; it is not labeled. That is the upper Ontario drain tunnel which extends from the Ontario mine to the southwest into the Judge mine. The Judge tunnel is indicated on Exhibit 168, practically in the center of the green tinted portion and is labeled "Anchor tunnel."

Referring to Exhibit 173. As we follow in the upper Ontario drain tunnel and the Judge tunnel we find it intersected by a vertical portion marked "Judge shaft." That is the main working shaft of the Daly Judge property and the same explanation would apply to that as to the west shaft. The Daly Judge shaft is located on Exhibit 168 and is indicated in the center of the green area and is marked "Anchor shaft." It is the same working that is shown as little black squares on Exhibit 115, and marked "Anchor mine." Leading off from the Daly Judge shaft are various workings in towards the diorite, practically parallelling each other and one lying above the other. There are the drifts and raises extending from the Daly Judge shaft into the Snake Creek drainage area. A few of them are indicated on Exhibit 115. They are the ones I have drawn in blue. The farthest one extends into the Bonanza Flat country from the divide between the Snake Creek drainage area and the Park City mining district about 3,500 feet. The total workings within the Snake Creek drainage area approximately 4,500 feet, there are projected onto this plane or section.

The underground workings shown on Exhibit 173, on the Park City side are delivering water, finally into the lower Ontario drain tunnel. I would say that the artificial drainage is away from the Daly fissure and the natural drainage probably towards it. The underground workings follow along the fissure and open up avenues for the water to be gathered into and that would carry them out and

drop them into the Ontario drain tunnel. The drainage in the diorite would be in any direction. There are large cracks in the diorite furnishing an ideal passageway for the water. They are all sizes and have no general direction. They cut each other, intersect and carry the water from one crack to another, so that water in the diorite would drain any way in which an opening was driven into it, even if the workings from the Park City side did not actually penetrate the diorite, they would draw water from the beds
282 and fissures which intersect both the diorite and the sedimentary rocks; would draw the water from the fissures and these fissures would probably be fed in some cases from the diorite. That is indicated by the evidence which I gave with relation to exhibits, 153, 154 and 155 where the workings from the Park City side are represented by the heavy white lines and the flow of water by the arrows. By taking the workings which appear in the Daly fissure and the Back Vein fissure 1910, as they enter the Bonanza Flat country and proceeding to Exhibit 154, and which represents the extension of the workings July 1st, 1914; then to Exhibit 155 which represents the extension of the working in 1915, and by observing the increase of the number of arrows, and in the size of the arrows, as well as the increase in the quantity of workings which have penetrated under the Bonanza Flat country, you can form an idea as to the increase of the flow of water in that direction and that illustrates in another manner what might be illustrated from the section 173, the difference being that section 173 is a vertical section whereas exhibits 153, 154 and 155 are in the nature of a plan.

The workings shown in white on these last three exhibits are the same workings as are shown on Exhibit 173 and are also the workings I have drawn on Exhibit 115.

The green ribbon representations on 153 to 155 represent the Daly fissure; the Back Vein fissure and the Jones fissure are the same fissures which are shown on Exhibit 115, and so labeled. In order to get a clear and comprehensive understanding of the situation, Exhibits 115, 168, and 173 should be considered together.

The Daly fissure where we have opened it up has a maximum width of 75 feet. The extent of the underground workings which are connected with the Daly Judge tunnel, or the Ontario drain tunnel, lower Ontario drain tunnel, would be several hundred miles.

We do not find any fissure in the country which is cut with the Snake Creek tunnel which compares at all in size or extent with the Daly fissure. The fissures encountered in the Snake Creek tunnel were comparatively small. There are no great faults cut by the Snake Creek tunnel. There are a few small displacements of, I should judge less than 50 feet.

We found tongues of igneous rock running out from the main diorite stock and intersecting a number of them in the tunnel.

283 Exhibits 168, 169, 170, 171, 172 and 173 received in evidence, subject to the objections of the defendant's counsel heretofore made.

Cross-examination:

None of the workings of the Daly Judge shown on the map encounter the diorite. There are several places in the western part of the property which are detached from the remainder of the mine, which are in the diorite. Also, the Jones workings which are detached from the remainder of the property are in diorite. The contour of the profile of Exhibit 170 was taken from the Park City Special, enlarged approximately ten times. Assuming the Park City Special to be as accurate as can be made upon that scale, when you enlarge the scale ten times it would magnify the errors ten times. The same thing is true of Exhibit 173 to the right of the line marked red, with the addition that it is only one-half the scale of Exhibit 170.

The vertical plane upon which 170 is cut is not the same vertical plane upon which 173 is cut. The workings on the Park City side are not on the same plane as the profile indicated by the irregular line at the top and also by the work underneath as that portion of 173 to the right of the red line marked "bend in section." Practically all of those workings are projected into the section. All of 173 below the line marked "Ontario tunnel", on the right, and below the line marked "Snake Creek tunnel" on the left, is an ideal representation, I never saw it at that point. Graphically I represent what I conceived to be there, and the same thing is true above the line of these tunnels. On Exhibit 173 the crossing of the lines is a conventional way of representing diorite, it is diagram-atic, that is all. I mean to be understood that what I have marked as "limestone" on the left is a conventional way of representing limestone, but that is all. The same thing is true as to the quartzite, the woodside shale and Park City Thayne's and anything else that may be shown upon them, the same thing is true as to Exhibit 169, except as to what I saw in the tunnel and on the surface. The rest is an ideal representation of the character of rock I conceived to be between the points I testified I saw.

On Exhibit 169 at a point marked 1,500 feet the hydrograph shows a drop on a straight line. When we ceased work there was a water flow represented by the height of the peak above the tunnel [floow]; it was approximately 17 second feet and that 1,500 means depth below the surface; we were in about 5,430 feet from
284 the portal. The perpendicular drop, and the line extending somewhat at right angles there, shows what the volume of flow was when we resumed work again and that volume was approximately eight second feet.

I have shown upon Exhibit 169, and its companion Exhibit 172, lines crossing the vertical section of the tunnel at some angle. On that part of the plat which shows the bore of the tunnel running horizontally across Exhibit 169, I have shown lines falling from the perpendicular crossing it from top to bottom and on 172 the same. It is not intended to be understood that the dotted red lines I have placed there represent all of the openings between the rock. I have indicated either the larger ones or such as I thought proper

and advisable to indicate, and the direction in which they cross the tunnel is shown upon the plan below. The same openings that extend vertically from the top of the tunnel shown on the section are the same openings which cross the tunnel from one side to the other as shown upon the plan below.

It was agreed between counsel that the cross examination of Mr. Friendly, upon the points testified to by Mr. McKay, might be considered as a further cross examination of Mr. McKay.

Redirect examination:

The dip of the beds is away from the portal of the tunnel, shown graphically on Exhibit 153 which is an enlargement of a portion of Exhibit 169. The dip of the beds on the other side of the divide is northerly.

As to the formations I have represented on Exhibit 173, and as to the general dip of the beds, the condition is substantially as shown by Mr. Boutwell in his professional paper which has been used so much in this trial.

Further cross-examination.

By Mr. Wedgwood:

I took the surface line of that part of 173 lying to the right of the line marked "bend in section" from professional paper No. 77. I have also taken the geological section to the right of the Daly fissure which is shown on Mr. Boutwell's section, I think it is his section DD prime, and projected that portion of the geology into the section. I have not taken anything from Boutwell's Exhibit 117 to the left of the Daly vein, except the surface line.

285 Redirect examination:

The tabluation marked "[Pla*k*nt*n*iff's] Exhibit 174" shows conditions in the tunnel as the tunnel proceeded. The note at the top of the fi*i*rst page is explanatory of the balance of the tabulation. It is stated "Data taken from field books No. 2 and No. 4 was taken at time the tunnel was advanced through the various points indicated. Data from Book G was taken at time tunnel was geologized in year 1914 and 1915." The figures 2 and 4 and the letter G in the first column on the left hand side refer to these books. The next column indicates the page of the book; the next the distance in the tunnel from the *the* portal; the next is headed "class" which is divided into small b, Cabital A, small e. These letters refer to an [arbit-ary] classification which we use in referring to fissures; a large fissure is called a Class A fissure; a small fissure is called a Class e fissure; a medium sized fissure is call a Ball b fissure. The next column is headed "strike". That means the strike of the fissure or fracture through the ground. The next is headed "dip", referring to the departure from the horizontal into the earth, and the last column indicates the quantity of water which entered the tunnel from the particular fissure or fracture.

The first item found in Book "G" at page 6, at distance 1715 feet is class b, strike due east and west, dip 49 degrees north, quantity of water slight drip. That described a fissure or fracture which was found at the time we were geologizing for the preparation of the first trial of this case. The explanation I have given as to Exhibit 174 applies to all of the exhibits so far as it refers to any of my notes.

I was present at the time Dr. Talmage and his son examined the tunnel for the purpose of preparing themselves to testify in this case, and also when Mr. Wentz was there. They did not go near the face of the tunnel as it then existed.

At the time of the other trial the breast of the tunnel was 10,600 feet from the portal. I have drawn a vertical arrow pointing down to the tunnel at the point where the breast was at that time on Exhibit 169 and 170. I have marked this point in the same way on Exhibit 168. From that point to the present face of the tunnel is 4,400 feet.

The tunnel had gone into the diorite about 500 feet on that date, and since that time, and up to the present face, it has been prosecuted in diorite alone. A portion of the tunnel, and the profile thereof, and of the country above it as to its length, is not
286 shown on Exhibit 169; a portion is shown on 170. The portion from 12,820 to 14,550, 1,680 feet of the last length of the tunnel, is not shown on Exhibit 169. The present face of the tunnel was reached about April 1st, 1916.

The point known as the last point of diversion of the Midway Irrigation Company on Snake Creek has been marked by Mr. Wentz on Exhibit 1-*a* as "last diversion", in the lower half of section 3, township 4, range 4 east, and also the elevation as 5,400 feet. The elevation of the portal of the tunnel is approximately 6,932 feet.

Referring to Exhibit 140, the note at the top of the first page, taken from Book 2, page 8, reads, "At 2,780 feet water appears in bottom, about 50 galons per minute, flows to 1,575, and disappears in fissure." I have indicated the two points on Exhibit 169 by an arrow drawn in pencil immediately below the line of the tunnel, and at station 1575 I have written the figures 1575 and at station 2780 the figures 2780. It is evident from my measurements that there are other instances of the same character. I have measurements taken in the tunnel at different places. They appear on page 2, Exhibit 149, on the right hand side of the page. The first measurement was taken at 1000 feet from the portal and the flow was the same as at the portal, 17.32 second feet. The next measurement was taken at 4000 feet and showed 15.19 feet; the next was 4320 and there I had 13.44. The flow had increased from 4320 to station 1000, substantially 3.9 cubic feet per second. The next measurement was taken at 4970. My measurement there was 15.05 second feet, so that at station 4970, which is 650 feet distant from station 4320 there was a difference between 15.05 and 13.44, approximately 1.50 second feet more at 4970 than at 4320, indicating that between those points there was a loss in the tunnel, and the only way that

loss could occur would be by disappearrance through the bottom of the tunnel.

The difference between the elevation of the tunnel at its portal and its present face is approximately 35 feet. The grade is three inches in a hundred feet.

There is water coming into the tunnel from fissures and fractures in the rock as well as from the bedding planes themselves. The dip of the fissures and fractures is not altogether uniform. Some dip towards the face; some stand vertical and some dip away from the face. These fissures and fractures, in places, afford an avenue for water to go through, as well as the beds. In my opinion the
287 water proceeds from one fissure or fracture to another. The fissures are connected in many cases; that is, the small fissures are connected in the tunnel; you can see the connection in some cases and there are others which do not appear. In my opinion the great majority of the openings in the tunnel are joint cracks. Joint cracks are nearly always connected up and furnish an excellent channel for the passage of water along certain beds.

The joint cracks are nearly always connected up and furnish an excellent channel for the passage of water along certain beds. A joint crack has an opening which does not extend outside of a single bed. That can be explained by referring to the model which was introduced by Mr. Blood as Exhibit 37. From my examination of the ground traversed by the tunnel up to the point of the diorite, I found the water entering the tunnel through the fissures, bedding planes and joint cracks. Of course, when it entered the diorite the water will flow in any direction through the cracks that appear in the diorite, so that whenever the diorite is tapped it will serve to permit the water to flow out of the diorite.

I know of the fault referred to by Mr. Tanner as the so-called "Frog Valley Fault", pointed out by him on the map which appears opposite page forty-four of professional paper 77 which has been referred to in this trial, and the map is marked "Exhibit 117." As I recall, Mr. Tanner gave his opinion that while the fault was not exposed between Cottonwood Canyon and McHenry Canyon that they connected. I consider it very doubtful to say the least. As is shown on the map, the Frog Valley Fault intersects the McHenry Canon fault and no extension is shown on the south side, furthermore, the formations to the south of the McHenry fault do not show the displacement which you would expect if this fault continued through. On page 96 of the paper Mr. Boutwell says, "The fault could not be found south of the bottom of the McHenry Canyon, nor could its actual relation with the McHenry fault be ovserved." I have made no examination of the fault and have no information more than Boutwell had about the intersection of those two faults.

The fissures and fractures cut by the tunnel are of various sizes. The ordinary fracture at the time it was encountered would not exceed six inches in width and was filled with detritus which washed out in the tunnel and left openings in some cases six inches, but

not often exceeding that. There are cases where the open-
288 ings are one and two feet wide. I saw no rocks in the tun-
nel that were rounded by the flow of water in the manner referred to by Mr. Tanner.

Q. I will ask you, Mr. McKay, if there is any opening or channel which appears in the ground cut by the Snake Creek tunnel from which any geologist, however, well read or expert he may be or however wide his experience may be can do more than give an opinion as a geologist as to how the water traveled beneath the surface of the ground which is cut by the Snake Creek tunnel?

Mr. Wedgwood: I object to it as incompetent.
The Court: I think he may answer.
Mr. Wedgwood: Save an exception.

A. No, there is nothing in the tunnel itself which shows the direction the water was taking when it was cut by the tunnel outside of the dip of the beddings and the strike of the fissures, strike and dip of the fissures.

It is not possible for a geologist finding a section of a rock showing what he concludes is a piece of slickenside, to determine by a mere inspection of that rock the extent of the fault or throw.

George D. Blood, a witness produced by the plaintiff, at the former trial and whose testimony was read into the record of the present trial, testified in substance as follows:

I am 45 years of age. My profession is that of a Mining Engineer. I was Consulting Engineer for the Silver King Coalition Mines Company at Park City for three and one-half years and General Superintendent and Assistant Manager for two and one-half years.

The extent of the underground workings of that company's property is more than 75 miles. This property is located northeast of the Snake Creek district, it joins it on the northerly water-shed of the Snake Creek district and continues for four or five miles to northeast of that.

I am acquainted with the country referred to here as the Snake Creek drainage basin. About the 18th or 20th of February of this year (1915) I went into the Snake Creek tunnel to make a general examination of the formation through which it passed for the purpose of testifying in this case. I went into the tunnel more than
two miles, to its face. Through the greater part of the
289 tunnel I was able to see lines of stratification, of fissures,
and the character of the formation. In a general way I made observations as to the manner in which water came into the tunnel. I particularly noted the presence of two dikes crossing the tunnel. I saw a third dike and noticed the changed character of the limestone beds near the end of the tunnel before I got into the diorite.

I have prepared a model which explains some of the terms used

in this trial. What I meant by a "limestone bed" is a rock of rather inferior character, banded by bedding planes or partings. There are five pieces of linoleum in this model. One piece would represent a limestone bed; each one would represent a bed.

A bedding plane is the margin of the bed. Each bed has a parting plane on either side of it. The white paper in the model between each of the layers of the model illustrates a parting plane, so that the white paper I have here is what is called the bedding or parting plane.

Joint planes result in the breaking of the beds into blocks. Joint planes extend beyond the bed in which they are formed.

I have five sheets of linoleum. Several of them are marked with a cross marking on top to represent the direction of the joint planes. Planes in such a lime bed extend from the top to the bottom of the bed and stop at the joints, this breaks the bed of limestone up into blocks. There are usually more than one set of joints and these sets may give continuous openings on the dip, or more or less in the direction of the strike. I have indicated and so written on the sheet that one layer, the upper one, represents limestone, jointed; the second one represents quartzite jointed; the third represents shale practically without joints and almost impervious, rather impervious. The fourth represents limestone, the limestone being jointed in each case. I have on the edges, in a direct line with the plane joint represented, cut through the bed, and we imagine those cuts extending completely through each block in which they occur.

I have represented the tunnel by a white line on the edge of the model, it is seen from the right to the left, commencing at the lower right hand corner and ending at the upper left hand corner. The beds in Snake Creek district generally dip northerly and the Snake Creek tunnel cuts a succession of such beds, and cutting through the bedding planes where the white paper is seen, and cutting through the joint planes where we see the heavy
290 white lines intersecting the incisions that I have made to represent joints in the beds. I have represented the basset edges of the beds coming to the surface and exposing the joint cracks at the surface; they are illustrated at the right hand end of the model and at the opposite end of the seam.

If the joint planes were sufficiently open and connected, the water would follow, as nearly as possible, a line on the dip of the bed. If water entered the basset edges and traveled along the bedding planes, if it could do so, it would travel in the direction of the dip; it would take the shortest course that it could take, conforming to the dip.

Water which finds its way into the upper layer or bed, to find its way into some lower level would have to pierce the parting or bedding planes and it would find that connection at such a place as the planes where the planes or joints in the upper bed intersected the planes or joints in the lower bed. There is not necessarily any relationship between joint planes of one bed with those of the bed lying above or below it. It does not necessarily follow that joint planes made of one bed are made at the same time as those of the

other beds. There is no uniformity, either in size or direction of joint planes in limestone formation. There is no way of determining the size of the blocks that are formed by joint planes in limestone beds. Generally the blocking in the Snake Creek tunnel is heavier in that portion from the 5,000 foot mark on, the beds are more massive there. From 3,000 to 4,000 the beds are generally quite thin and the joints smaller, but they are curved more frequently.

While I was in the tunnel I observed fissures. I formed the opinion that the underground waters in that section of the country through which the Snake Creek tunnel is driven would flow to the north and as far north as it could find egress from the beds that we see in the Snake Creek tunnel.

I have made a diagram for the purpose of illustrating what I mean by saying that water would flow to the north, and illustrating the various conditions I saw present in the tunnel. It is marked "Exhibit 36".

The location of Heber Valley is represented at the right hand side of the map, marked "Heber Park Drainage, elevation 5,500 to 6,000 feet. The Salt Lake Valley elevation, 4,250 to 5,000 feet, is represented at the left corner of the diagram. The purple line at the top of the diagram represents the general surface that would be intersected in the supposed section. The top point is
291 marked "Clayton Peak, elevation 10,728 feet." I line running at right angles, or horizontal, of about fifteen degrees, represents bedding planes. The formations are represented by cross hatching, which is the conventional sign for limestone.

The two dikes that I paid particular attention to in the tunnel are in orange and each is marked "Porphyritic Dike." The beds of limestone shale are illustrated in the green colors. The Snake Creek tunnel is represented by a black line marked "Snake Creek tunnel," the portal of which is [macked] "Portal Snake Creek tunnel 6,932 feet." The diorite at the face of the tunnel is illustrated in the red coloring and marked "Diorite Stock." It is directly under Clayton Peak, which is of a granite structure also. The area marked "Laccolith" is intended to represent the granite mass underneath the Wasatch mountains. It may be assumed that there is a mass of that kind through the intrusions that have come into the country that we can see. Such a condition would account for the porphyry dikes seen at the end of the tunnel which is an occurrence of granite rock on the western margin of the Salt Lake Valley. No part of the diagram purports to be drawn to a scale; merely illustrating according to my testimony.

Water which enters the joint planes in the basset edges of the bedding planes from the Clayton Peak stock, and the porphyry dike, at the second porphyry dike, as illustrated in this diagram, would follow, if there was a passage for it, from one set of joint planes to another as nearly as possible on the dip of the beds in the direction of northerly, water following the course I have mentioned would come to the diorite stock. The course the water would follow through the diorite stock would depend on where the outlet for the

water was easiest. The diorite stock is jointed; these joints connect with each other to the source as a passage for it to the north. If, as I know to be the case, in portions of the district, the beds, similar beds, are to be encountered on the north side of the dikes, dipping to the north and turns more or less direct by coming through fissures which I have represented by yellow lines, more nearly in a vertical direction.

Diorite does form joint planes. There is a difference between that material and porphyry in that regard. We are able to see them in a granitic rock more commonly than in porphyry. We may be able to see some of the joints in porphyry but porphyitic rock breaks down in contact with water and forms extensive joints and these
292 joints are filled with clay material. Diorite does not break
down to- readily and the joints are more open in granitic rock of the character.

We may infer that there is stratified material to a considerable depth below the tunnel because of the outcrop of the limestone strata to the southwest of the portal of the tunnel. I should say the depth was approximately a mile.

There is no necessary connection between the surface flow of water and the underground flow of water in such a country as Snake Creek drainage basin.

Cross-examination:

The fissures are not illustrated on Exhibit 37. This exhibit does not fully represent conditions as they exist in Snake Creek. There are matters not illustrated by the model. I did find fissures in the tunnel. From my observation, there is one fissure in the tunnel four feet wide that is completely filled, and then there were fissures of a very narrow width.

There are openings at least two feet in width cross-cut by the tunnel and many of them did carry water. I have no note as to whether there are hundreds of openings that carry water; a number did and some did not. Some that did carry water approach the perpendicular; some appear across the tunnel; some carry water up to the roof and from the roof down; some flow from one side, some from the other, and some flow from both sides. I did not make any observations as to the openings that were not flowing water for the purpose of forming an opinion as to whether they had flowed water when first struck.

I saw two porphyry dikes. The first about 2,600 feet in and the other at about 4,700. As to whether there was timber where the porphyry crossed the tunnel in the two instances I saw, there is timber and it is in connection with these dikes. As to the place where the concrete occurs—I could not see that; as to whether there is porphyry there or not, of course I do not know. I could not accurately determine how wide the porphyry dike was at 4,700 because while the southerly face of the dike was quite plainly visible, the northerly face was obscured by timbers. Timbering means disintegrated ground, that won't itself stand. A portion of that dike was disentegrated in the sense that it was unsolid.

In my opinion the selvage edge of the south side of the dike is impervious to water. My memory is that the selvage is an inch or two thick, but I did not make any particular measurement of it.

293 As to evidence in the tunnel to show that water did flow along the bedding planes that were cut by the tunnel to the porphyry dike, I will say that there are joints apparently in that direction of the tunnel and if those joints connect with other systems of joints, there would be an opportunity for water to flow in the direction of the bedding planes, otherwise, I do not know that there is any evidence of water having flowed at all. If water had flowed along the lines of the bedding planes up against the impervious selvage on the south side of that dike it would have stayed there if it did not have an outlet below on either side. If it had flowed up against that impervious selvage and there was hydrostatic pressure on it, it would have been forced somewhere; otherwise it would stand under the static head. In either case it would have led to the disintegration of the porphyry. I did not see any evidence of such a stand of water there; no static head or flow to find its outlet up or down or sideways. The porphyry is more or less decomposed; not in the sense of broken, but in the sense of having changed chemically. There had been sufficient moisture there to decompose the dike.

I would not want to undertake [*ot*] count the lines of the bedding planes exposed in the roof of the tunnel in that 2,700 feet. I did not notice any water flowing along the lines of the bedding planes between the 2,700 feet from the portal to the porphyry dikes.

If that porphyry dike rose to the height of the surface above the tunnel and extends on either side of its disclosure in the tunnel in an approximate straight line it would cross the ravines, gulleys or canyons in which both Lavina Creek and Snake Creek flow and would be cut down to the bed rock along those streams.

As nature works out her different situations at different places, the top of the porphyry dike might be below the level of the passages exposed in the tunnel anywhere outside of where I actually saw it. I think it is a fair inference that it extends some distance on either side, to some distance above the tunnel, and it certainly extends to some massive igneous rock at depth.

At 4,700 feet, or at any other places I did not see any porphyry dike that was solid, either as a piece of putty or as massive. There is a mixture of conditions there. The conditions were such that the ground fell unless it was timbered.

I did not see any evidence to show that water had been confined between the 2,700 and 4,700 [foo*k*] dikes, in the sense of
294 a reservoir, but confined in the sense of water being of a somewhat different character in the portion of the tunnel between those dikes. The water coming in there at certain places gave an odor of sulphurated hydrogen and was [wa*mr*]. Under the conditions stated, the second dike would be cut at the surface the same as the first if projected would cross Lavina Creek as well as Caribou Gulch.

At the 10,000 feet there is considerable water. The diorite i very badly broken. It is expected that you will find void spaces ex tending for considerable distances in diorite. It is evident that stream of water that is equivalent to a body of water a foot squar and seven feet long is projected into that tunnel at that point ever second, but it does not have to be of the cross section of a squar or anything; it has an opportunity to come into the tunnel for distance of 30 or 40 feet. It comes out of the mass of the broke rock or boulders, or anything you see there, angular, and the evidently dropped from some fissure or joint, it is not from on void opening extending along the tunnel but a number irregular i shape.

There are three or four places along in the tunnel varying i length from 40 feet to a longer length where water drops down i the tunnel in substantially heavy rain, but the major portion of th water comes in through the joints. I would say there was 500 fee out of the 10,000 feet of the length of the tunnel where water drop or runs down quite heavily from the roof. Outside of that 500 fee the roof is rather dry. Then for about 9,500 or 9,700 feet the line between the bed planes are exposed, but you can't always trace them because there is not a clean clearage between them and in many places it is difficult to determine which way the dip of the strata runs If the strata dips to the north, it is cut by the tunnel in the roof an the tunnel has cut across each layer of strata and throughout 9,000 feet or more of the tunnel no water comes out from those places.

If the water in that country flows to the north, as I gave my opinion that it does, it does not come out in the tunnel from the bedding planes because there is no opening for it to come out into the tunnel through the bedding planes. The substantial quantity of water that comes in there, so far as perceptible, comes through the joints that run nearly perpendicular.

I do not pretend to say where these fissures go or to what extent they go. They may be of a given width where they are exposed to your vision, and at an indefinite point at one side or the other more or less, they may be twice as wide, one-tenth as wide or one-hundredth as wide.

295 The bulk of the snow goes off in the Snake Creek country in the latter part of June or July. The water supply of Snake Creek and Lavina Creek after the snows are melted, comes from underneath the ground if it does not come from the atmosphere in the form of rain. The supply of the springs that feed Snake Creek necessarily comes from rocks through openings located in the drainage area of Snake Creek because the springs are in that area, so that all of the water that flows in the natural channel of Snake Creek and that has flowed in it since it was appropriated by those farmers, in the low water season, comes out of the rocks within the drainage area of Snake Creek. Those rocks may serve only as a passage from some other basin, but it flows through these openings within the drainage area of Snake Creek or it would not come out there. And wherever it may first enter the ground it necessarily follows along the same course in its natural flow under the ground

until it finds an opening out into the waters of Snake Creek through the springs or seepage.

The rains and snows come from the skies and a portion thereof enters the ground from year to year and the tendency is to fill up all voids underneath the surface. After the water gets into the ground it follows the line of least resistance. If the line of least resistance is below to the deep, the interstices in the [*gro*] ground fill up; the water cannot get out and the quantity that goes out is limited by the openings upon the surface, so that if the supply was greater than the capacity of the discharge opening, you have the water level in the ground to the rocks above the level of the opening.

Where water did flow when first cut by the tunnel and ceased to flow, it shows that the water supply with free communication down to the level of the tunnel has been drained.

Referring to Exhibit 22, a hydrograph of a section of the tunnel. It shows that in June 1912 there was 6.3 second feet of water flowing out of the tunnel and that in February 1914 there was the same quantity flowing, after an interval of substantially eight months. Between those two periods there was a flow of something over 14 second feet. That shows that between the time the 6.3 second feet commenced to flow and the time the flow again got down to 6.2 second feet a supply which flowed out of those openings had been lessened or diminished. It indicates to me that a storage body of water had been exhausted.

If Snake Creek flows as much again water before it enters the Provo river as there is in the stream nearly opposite the Snake
296 Creek tunnel it is a demonstration that the additional quantity of water finds its way through the underground strata below that point and that whatever added quantity there is as you go down the stream comes out of the rocks in the fractures and openings, and that is regardless and independent of the condition of the strata—it is there if it gets there.

It is not my opinion that all of the waters of the sub-surface drainage of Snake Creek flows to the north. I cannot give an opinion as to how much of it flows to the north. It might be the smallest fraction of it.

Redirect examination:

There is nothing that I know of which would indicate from what drainage basin the waters of the springs that come out of the Snake Creek area come from.

I have not intended to say that water flows to the north in the bedding planes. If it does flow to the north it flows through the joint fractures in the beds.

In a great many places where we now see openings it is evident to me that they contain more or less of solid, broken material. As the tunnel is driven, the blasting that was carried on in connection with the driving of the tunnel would loosen such rock and give it a chance to drop out. I take it there would be very few if

any of these void spaces that were void spaces before the tunnel was driven.

Exhibit 174 received in evidence.

O. N. FRIENDLY, recalled by the defendants for further cross-examination, testified in substance as follows:

Exhibit 142 was admitted in evidence without any testimony as to how those measurements on the extreme left marked "Orrock" were made. I put them in the exhibits. I do not assume that they are correct or incorrect, they stand unimpeached, I do not know anything against them.

Referring to Exhibit 144, hydrograph of Mountain Lake tunnel. The high point is by Searle's measurement about the middle of August (1907) 13.3 second feet. Now referring to Exhibit 142, the high point marked "Deming" is 9 second feet, that was the first week in August. Also referring to 1916 measurements by Friendly and McKay; that is the first week in August and the flow was 9.3 second feet. The high point in 1917 was the first week in
297 August, and was 10.75 second feet. 1915 was a very low year. I do not know what the high point was in 1911, the only measurement we have by Deming, the first week in August, is 8.5 second feet. The only measurement we have in 1912 is the first of July; that was 9.5 second feet. In 1913 the measurement given is the last of June, 8.8 second feet was flowing. Referring to the Orrock measurement of 1910, the first measurement is between the 20th and 25th of September. Searle found in 1907, as shown by Exhibit 149, 9 second feet; Orrock found at that time 6.6 second feet. On about the 20th or 25th of September, 1914, my hydrograph 142 shows about 6.2 second feet flowing; in 1916 between the 20th and 25th, about 7 second feet; in 1917 from the 20th to 25th, about 7.2 second feet.

Redirect examination:

1907, at the time the measurement was made in the Mountain Lake tunnel by Searle, shown on the hydrograph 149, was a year of high water.

I desire to explain the measurements shown on Exhibit 142 and 149. Not only is the water practically the same on the same date for the years 1914, 1916 and 1917, but also for the year 1910, it was just a little less. The maximum variation as between 1910 and 1917 for the same date would be about .8 of a foot. In 1910 there was no water flowing in the Snake Creek tunnel. We struck water in the Snake Creek tunnel in April, 1911.

G. R. McKAY, recalled by the plaintiff for further direct examination, testified in substance as follows:

I have prepared a model for the purpose of showing the flow of water in Snake Creek, Lavina Creek and from Snake Creek tunnel covering the months from and including April to and including

the month of October of the years from and including 1912 to and including the year 1917, which has been marked "Plaintiff's Exhibit 175." I would call it a series of hydrographs for the years mentioned showing the combined flow of water in Snake Creek tunnel, Snake Creek and Lavina Creek. It is not a hydrograph of the total flow of Snake Creek above the last point in diversion of defendant; it is a hydrograph of the flow of Snake Creek opposite the Snake Creek tunnel.

Mr. Wedgwood: I make the same objection: It is not competent; does not prove anything nor tend to prove anything.

The Court: Same ruling.

298 The Witness: It has been constructed from hydrographs which have already been introduced in evidence. Each one of these sheets which appear in the books in reality is a separate hydrograph showing the flow of water by a curve. Each is a hydrograph for the separate years; the first for the year 1912; the second 1913; the third 1914; the fourth 1915; the fifth 1916 and the sixth 1917. The scale appears on each hydrograph.

Two of those larger squares are equivalent to five second feet; in the horizontal scales three of the larger squares are equivalent to a month, reading from left to right. Wherever you find the back line, which apparently follows along the upper border of each one of these hydrographs, it represents the curve of the hydrograph; the flow in second feet is indicat- by the height of the curve, from the beginning of the ruled portion at the bottom of the sheet it is shown on the face of the box.

The various plates indicate the hightest point reached by the water flowing in the two creeks and the Snake Creek tunnel each year on the date we took the measurements.

This model does not indicate that the high flow has come earlier since water was struck in the Snake Creek tunnel. It indicates there is a variation in the high point of the flow for the succeeding years; there was a recession of the high point from 1912 to 1914 and an accession to 1916; 1917 as between 1915 and 1916. The high flow in 1917 was much later than in 1912; in 1916 about the same; in 1915 later, but in 1914 and 1913 it was earlier than in 1912.

The point after the high runoff has ceased for each year is indicated by the point where the hydrograph straightens out into a flat curve or runs down sharply from a high peak.

Mr. McMillan: We offer this model in evidence.

Mr. Wedgwood: I object to it for the reasons I have heretofore given.

The Court: The same ruling may apply.

Mr. Wedgwood: Kindly save an exception.

299 O. N. Friendly, recalled by plaintiff for further direct examination, testified in substance as follows:

We first struck water in the Snake Creek tunnel at station 2780, 16 feet north of the first porphyry dike. Between the portal of the tunnel and that station no water was encountered coming out of the tunnel.

At a height of 110 feet vertically over the tunnel it is crossed by Snake Creek as indicated on Exhibit 169. No water was encountered in the tunnel as it passed under Snake Creek. It was about 1,700 feet beyond the point where Snake Creek passes over the tunnel where we struck water, 50 gallons a minute, a little over one tenth of a second foot. It ran about 1,200 feet and then disappeared in the bottom of the tunnel. We next struck a heavy flow at 3,140, about 75 feet past the concrete, which is indicated on Exhibit 169 by the heavy black line over the tunnel.

From the time we passed the first porphyry we encountered great difficulty in holding the ground. It was badly decomposed from the action of water; it had lots of large boulders in it and we could not hold the ground with timbering; we had to put in re-inforced concrete as a lining; we concreted the worst of it. The ground was the same character I have mentioned when we passed through the first porphyry as the porphyry dike cuts down through the tunnel a black, decomposed lime shale, looking very much like shoe blacking. In my opinion that condition was caused by decomposition by the action of water. I think it formed a dam. It laid up against the dike and decomposed the formation behind it. We did not get any flow of water in that material. It was impervious. As to character, the ground where we struck the flow, after we passed through the concrete portion, was a fairly hard ground. We struck water in a fissure indicated on Exhibit 169, 75 feet beyond the concreted portion, and the flow was a little over 5.50 second feet. Next we had some dripping water at 3,770. We next struck water of any consequence around the 4,000. I do not remember what it looked like, I have no notes taken at that time. The water increased to 5 second feet after having dropped down to two second feet.

We next struck water of any consequence where there was some folded bedding planes and also some fissures, on Exhibit 172 it is located over the point marked "4,000" in red. There was a large increase in water from that point to the second porphyry dike. At 4,800 we passed through that dike and there was a great in-
300 crease in the flow of water as indicated by the hydrograph
169. The water flow at one time jumped as high as 17 second feet; it immediately dropped off however, and then continued more or less uniform to the 6,700 foot point, on Exhibit 172 it is marked just to the left of the point 7,000. We then had a series of increases with a small decrease between each one up to 10,500 when we had a sudden increase shortly after we entered diorite at 10,200. The large increase at that point was due to a fissure in the diorite which came in and went out on the east side. At that point the ground was so heavy that we could not hold the timber and we built a switch around the tunnel on the left hand side as you go in and then cross-cut to the right and joined up the main heading from the back side. This fissure was filled with large diorite boulders and cracked pieces of diorite, large chunks, weighing probably 15 tons apiece.

The water came in from the entire fissure and also from the cross-cut "W." I have marked on Exhibit 168 the letter "F" at the point where the fissure came in and went out. That was the

face of the tunnel at the time the former trial took place. Hydrograph 169 shows an increase of about eight second feet of water at that point.

There is indicated on Exhibit 169 a number of the fissures and fractures cross-cut in the tunnel by the red lines. They were typical fissures inasmuch as they were cracks across the beddings and they were variable in size, but we had none of them showing any great movement; we had no major faults in the tunnel. By "major fault" I mean a heavy throw of the formation between the walls. These fissures were small and medium size, all except one, which was a little bit larger than normal and had a little ore in it. That was at 4,500 which is the third red line to the left of the second porphyry and is right in where the headings are badly folded and between station 4000 and 5000.

I did not find at any point from the portal to the face, fissures comparable with the fissures shown on Exhibit 153 to 155. I have not determined the actual throw of any of them, but I am quite confident none of them will throw more than 50 feet; I mean a vertical throw of 50 feet, at the most. I think the largest was probably five or six feet.

By Breccia I mean the ground-up zone between the two pulls of the fissure. I do not remember of any open water courses where the fissure was not filled with material of some kind. After cutting
the fissure with the tunnel the filling would fall out, leaving
301 an open space. I never saw any rocks which were rounded
by the flow of water. When we cut into the diorite we found a large number of joint cracks, in fact the entire diorite is just a mass of joint cracks; they are always open; of course they are not very large. They would let water through like a sieve in any direction; there are millions of them running in every direction.

If water is found in the diorite and you pierce that diorite from any side it would tend to relieve the water from the diorite. In driving through the diorite the heading is always wet. In place of the water gradually dropping off to some extent, it not only held its own, but gained a little. After we passed this fissure in the diorite which I have referred to there were low peaks in our hydrograph as we found at various places before we entered the diorite. That illustrates that water was coming in more constantly.

I am familiar with Exhibits 153 to 155 and with the underground workings represented at the top of those maps and with the fissures represented.

All of the workings in the Judge, shown on Exhibit 169, from 1910 to 1917 were towards the diorite. We had a flow of water which increased as we went towards the diorite at irregular intervals. We had to cease work in a number of those stopes because of the heavy flow of water. As the fissures approach the diorite they will draw more water from it, even before they actually enter the diorite. The main Daly fissure I have actually traced to the divide as marked, "Daly Fissure" on Exhibit 168.

Exhibit 176 received in evidence.

G. R. McKay, recalled by plaintiff for further direct examination, testified in substance as follows:

I have prepared tracings of Exhibit 168 to show the extent of the diorite as it is delineated by the various geological surveys. The extent of the diorite is shown on Exhibit 177 on the same scale as Exhibit 168. The heavy brown line on Exhibit 177 represents in a rough way the extent of the diorite in that district. As you lay map 177 over 168, when properly oriented it will show the limits of the diorite with reference to the mining districts as shown on Exhibit 168*fi* rather [rou*u*ghly].

Exhibit 177 received in evidence.

I took Exhibits 178 to 182 inclusive which are photographs. Exhibit 178 was taken November 31, 1917. It represents a por-
302 tion of the lower Lavina Spring and is marked "Spring No. 1" on Exhibit 139. The total width of the spring is 148 feet.

Exhibits 179, 181 and 182 represents the spring which is marked on Exhibit 139 No. 4. Exhibit 179 shows the source of the spring, the water issuing from bedding planes which are open at this particular point.

Exhibit 182 is a close-up view of this open bedding plane. Exhibit 181 is a picture of the discharge of this spring at the top of the bank where it reaches the Lavina Creek and joins the main stream.

Exhibit 180 is a picture of Spring No. 3, so marked on Exhibit 139. It is a picture of the discharge from this spring where it flows over the rocks into the canyon of Lavina Creek.

The photograph Exhibit 183 was taken by myself about the 10th of October, 1917. It shows the top of Clayton Peak and the joint cracks in the diorite at the top of the peak.

Exhibits 178 to 183, admitted in evidence.

Page 60 in Professional Paper No. 77 shows the joint cracks on Clayton Peak very well.

O. N. Friendly, recalled by the plaintiff for further direct examination, testified in substance as follows:

I have testified that I am familiar with Exhibits 153, 154 and 155. I am also familiar with the various streams which are represented on those exhibits. Caribou Spring is there shown as an intermittent stream. I have known that stream since 1909. Its flow is very small. On the 8th of last August (1917) its flow was .04 of a second foot; on June 25th, 1915 it was .39 of a second foot. Its flow was a little less in October and November.

White Pine Creek shown on Exhibits 153 to 155 is an intermittent stream, except as it is fed by the reservoir and Bonner's canyon and Bogan's. Exhibit 139 shows the intermittent streams by broken

lines. There are several more than I named on Exhibits 153 to 155.

I have had an opportunity to observe the flow of waters from the head of Caribou and of Lavina Creek down to the point that has been referred to as the last place of diversion from Snake Creek by the Midway Irrigation Company from year to year, but I
303 took no measurements until the dates stated in the tabulation, which has been placed in evidence. I have formed a judgment as to whether or not the flow of Snake Creek has diminished or increased during that period (since 1909). It has increased equal to the tunnel water at various times. It is my judgment that the waters which have been flowing out of Snake Creek tunnel are waters which have been added to Snake Creek and which formerly went underground.

As to how the underground waters flow, I as a geologist can say that the most favorable directions are along certain lines, but I cannot definitely say that water goes north, east, south or west, and in my opinion, no other geologist can give any definite opinion upon that question without an actual cutting of the ground so as to expose the formation.

From my observation of the stratification which was cut by the Snake Creek tunnel it is my opinion that the most favorable direction for the underground waters would have been to the northwest, but as I have already said, it is impossible to say that they all take that direction or which direction they did take.

In the tunnel there was no evidence of water flowing in the derection of the dip of the beds. All of the water that was coming into the tunnel came in in the beddings, it is impossible to state how water is moving; it just simply comes into the tunnel and you do not know how it was moving 10 feet in the rock wall; water comes in through the crevices and that is all you can tell about it.

There are 300 or 400 miles of tunnels and a great many miles of stopes, raises, and winzes on the Park City side.

Exhibit 173 in a general way correctly represents the formation on the Park City side and also the dip. On the Park City side we have a large number of cases where the upper levels of the workings are very wet and the lower levels very dry. We also have cases where it is the reverse. This is illustrated on Exhibit 155. The 2,300 level is right under the 1,200 level and is almost dry with very little water in it. The 1,200 level is delivering about 2,000 gallons per minute. We have the same thing in the 1,400 level, it is very wet where the lower levels are dry. The 1,600 level on the Daly Judge is very wet. The 1,900 level on the same vein underneath is very near dry at that point. Then we have also a number of other cases in adjoining mines. The 900 level of the Daly West is wet and the 2,300 under it is dry. When you have a wet for-
304 mation or trouble in mining operations because of a wet formation, the running of a drain tunnel underneath does not always relieve that situation.

I think the No. 2 Ontario drain tunnel was driven in the early 90's. Ontario No. 1, I think was driven in the 80's. Both were

driven for the purpose of draining the country. The Spiro tunnel is now being run into the Park City mining district. It is just a little under two miles in length. It is being driven also for the purpose of draining the country. It was started about two years ago.

The prosecution of underground workings or cutting of a drain tunnel beneath a shaft that is wet will not always relieve the shaft of its wet condition. I can name a number of concrete illustrations.

There are a number of mines in the Park City district which have actually been flooded so as to cause the discontinuance of mining operations since the running of the Ontario drain tunnel. There is the East Ontario which is almost over the Ontario tunnel. About three years ago they were sinking a shaft; after shooting a round of holes, the men had to climb fast to keep from getting drowned. They were about 175 feet down when they struck water. She is practically filled with water now; that was about three years ago.

In the case of the St. Louis Ontario, they were entirely drowned out in spite of their pumps. This is about 2,000 feet away from the Ontario drain tunnel and well above it.

The American Flag has water for 400 feet above the Ontario tunnel level and she is unable to work her lower levels, the lowest being the 1,100 foot level, which is about 300 feet above the Ontario. It was not until the 1,100 foot level was open that the mine was drowned out. The Ontario drain tunnel follows along the American Flag for over a mile and is within 250 feet of that property during all of this distance and there are still other properties I can name.

In order to relieve the wet condition of the underground workings of the Alta district, a drain tunnel is being driven on the Big Cottonwood side and another on the Little Cottonwood side. I know the Columbus Mining Company and recall the recent drowning out of that mine. I also have a number of interesting cases. One of them is the Judge mine where within the last sixty days they have been completely drowned out, and the raise is not up 150 feet from the perfectly dry level; we raised on the fissure which
305 was almost vertical. We have in the Judge mine about 10 stopes with very rich ore bodies on our upper levels which we cannot work at this time because the ground is too wet. I mean levels above the 1,200 and under the 700. Our lowest level is the 2,300 foot level.

The Daly Judge workings at the Jones shaft enter the diorite at the 1,260 foot level and also a winze which we have recently opened on the divide to Big Cottonwood. The 1,800 foot level corresponds with the levels of Snake Creek tunnel; Snake Creek tunnel will hit the Judge shaft 1,830 feet under the collar. The 2,300 of the Daly Judge is connected with the 2,500 which is the Ontario drain tunnel level so as to make openings from one down to the other; avenues through which the water may flow.

The Ontario drain tunnel runs practically up to our side lines. The end of this tunnel on Exhibit 168 is shown as No. 3 shaft. During the time I was with the Ontario Company this tunnel was continued and now runs as indicated by the red line, to the Daly shaft

No. 2, thence to the Daly West shaft and thence to the northwest to the lines of the Judge Company which I have placed upon the map in red, connecting back with the Ontario drain tunnel which is shown in black.

Porphyry exposures on the surface are shown on Exhibit 139 by red broken lines with the word "porphyry" written in red beneath. I think the porphyry on the surface is a continuation of the same porphyry intrusion cut by the tunnel. In my opinion this dike acted as a dam upon the flow of underground water through the country cut by the Snake Creek tunnel to hold back the waters from passing. Everything was dry until we crossed the dike; as soon as we passed through the dike and the gouge on the other side and a little of the hard rock, we immediately got water.

I do not think the gas (encountered in driving the tunnel) was all from the water. There was some of it from the rock itself; that is from the oxidation of the rock, would take out the oxygen in the air, but the entire appearance of the rock showed it was subjected to the action of water for a long period. That condition could not have existed if the water had been flowing out through there, it was banked up.

We found the same formation we concreted through in the tunnel on the surface, marked on Exhibit 139, "porph*p*ry"; the lower one down on the right-hand side.

306 The purpose of running this tunnel was to act as a main artery running out for the development of the southwest portion of the Judge property, of the Great Western property, and of the Mountain Lake property, as well as any other properties to the north who might want to be served by it in doing their underground operations. It was to develop the properties of the Snake Creek Mining & Tunnel Company. When it was originally started, it was the intention to branch at a certain point and run in different directions; that point was at Clayton Peak. We have turned the tunnel at Clayton Peak northeasterly towards the heart of the Daly Judge property. It was the intention originally to run another branch to the left and still is, to serve the Knight properties, known as the Great Western and the Steamboat. There will be a branch from some distance ahead of the present face which will run to the northwest under the Big Cottonwood holdings of the company. The tunnel was originally driven for the purpose of developing these mining claims and for the transportation of ore, for the purpose of working these properties and also for the purpose of draining them and for increased ventilation.

Q. How many acres of [gr*a*ound] are covered by the Judge holdings?

Mr. Wedgwood: I object to it as incompetent and immaterial under any issue here.

The Court: Same ruling.

Mr. Wedgwood: Exception.

A. About 2,500 acres.

Q. Can you give us any idea as to the value of the ores which have

been extracted from the properties which now constitute the Daly Judge properties?

Mr. Wedgwood: We object to it as entirely immaterial, irrelevant and incompetent.

The Court: What do you claim for it?

Mr. MacMillan: Simply this, if your Honor please, to go back to one of the first statements I made in the case, that counsel will claim in his argument, as he did before, I imagine, that the holdings of the Midway Irrigation people are valuable, and he attempts to compare the mining industry with the agricultural industry, etc. I think it is important, therefore, that the court has some idea of the value of the ground which is being served or is to be served
307 by this tunnel. If it is incompetent and irrelevant, it won't hurt anything, if it proves to be irrelevant; just take a minute of time and it cannot hurt anything.

The Court: I am quite sure it would not do any harm; from my point of view it wouldn't do any good. You may take the testimony.

Mr. Wedgwood: Save an exception.

A. In the case of the Judge I would estimate it at about twenty million. In the case of the West Company which is now under the same management and will unquestionably be served by the tunnel, it is in the neighborhood of twenty-five million.

The Witness: At the present time there are large and extensive bodies of ore blocked out in the Daly Judge underground workings; mining operations are being carried on continuously in that ground.

I know about three culverts in the Snake Creek district that were pointed out on Exhibit 1-*a* or 1. There is always sudden rainstorms in that area and those culverts would appear to me to be necessary to take away any of the sudden flows of water, and they have serious cloudbursts there.

I am familiar with the conditions shown on Exhibits 107 and 108. That is a typical cloudburst deposit.

I know of the Frog Valley Fault. There is every reason to think that the Frog Valley Fault ends at McHenry's canyon where the McHenry fault cuts it off.

Cross-examination:

I am intensely interested in the results of this case. I have a very strong desire that the plaintiff secure a decree awarding it the water flowing in the tunnel.

Passing from the surface downward the ground contains more and more water until it becomes saturated and the water moves. A region of movable water rises and falls with the season, but never below a certain level, depending upon the climate in the particular place. The highest level at which water is always movable is called the level of perpetual ground water.

I do not know whether or not there have been issues before the courts of this State in which the level of ground water, either the

natural or artificial ground level was a factor, and the chief
308 factor, with relation to the flow of streams. Nor do I know whether or not the question of the feeding of surface streams by the artificial spreading of water upon the land has been the subject of litigation in this state. I know nothing of the conditions which resulted in litigation by reason of the State building a dam at Logan and impounding water. I know nothing of the conditions concerning the rise and fall of Utah Lake which resulted in litigation among the users of water of the Jordan river and the owners of land bordering on Utah Lake. I know nothing of the history of Utah Valley and Heber Valley through which the Provo river runs as to the facts which have been developed in litigation in regard to the use of the waters of that river.

I know nothing of the facts which has been developed in regard to the flow of the Sevier River and the volume of its flow by reason of facts developed in regard to the changed condition of ground water brought about by the work of man.

As a general proposition it is true that the level of ground water has a direct and controlling influence upon the flow of natural streams within the drainage area, within which that ground water is situated. I dispute that to be a proposition which is applicable to every stream. It is a fact that all springs, seeps and streams as to volume of flow, are controlled wholly, each in itself as a unit, by ground water conditions, but not by the ground water level. I dispute that the flow of each individual spring, is controlled by ground water level.

I have never been a witness in any case involving the flow of underground waters or been connected with a case involving the flow of underground waters and their relation to the flow of surface streams within their drainage area, except in the case we are now trying. I have had no advantage of hearing the testimony of men who have spent time and thought upon developing questions of fact and their relation to existing conditions, but I have read a great many of their books.

Leaving out the question of the action of water more or less impregnated with some re-agent, and its action upon the rocks, its action underneath the earth's surface in different chemical processes, expressly excluding that character of discussion, it is a fact that in standard works of geology and physiography the treatment of underground flow with relation to surface streams is confined to two
309 or three pages. There are a number of papers which treat of underground water, published by the Government, but most of them treat of the geology of a certain district and the water conditions found there.

I have expressed positive, unqualified opinions as to the pertinent facts relating to the ultimate facts in this case. I have great reliance on that judgment. My special qualifications warranting me in expressing such positive, unqualified opinions are that I have had a very thorough and detailed knowledge of the drainage and geological conditions of the Park City district. During my period of work there, I very carefully observed water conditions so that I know the actual conditions under which the water flows out of the mines and

into the mines in that district, and in addition to that I have observed the water from the Snake Creek tunnel. I noticed the water in lower Snake Creek first in the summer of 1911. I made no measurement of it. What I have detailed, my trip through Midway, my trips over the cut-off, my trips over the trail on horseback, up on the hill out of the canyon of Lavina Creek, three times on foot up Lavina Creek and twice up Snake Creek is not the foundation of my unqualified and positive opinion that Snake Creek as a whole flows more water now than it ever did before; the main foundation is our water measurements. Leaving out the measurements, the opinion I expressed from observation has no further data as regards observation of lower Snake Creek, except that I made a number of trips up Caribou Canyon going to Brighton. My first observations of the lower part of Snake Creek was in 1912; that, with the measurements I have is the foundation upon which I based this positive and unqualified opinion.

I produced a diagram-atic representation of precipitation for certain months, numbered 145, the Heber precipitation. I did not know at the time the map was made that from the year 1914 down the precipitation was taken in Snake Creek canyon; I found it out two or three days before I introduced Exhibit 145. Knowing that the precipitation from 1914 to 1917 inclusive for Snake Creek canyon was available I was satisfied to produce as evidence the Heber City precipitation and render upon it as to positive judgment with relation to Snake Creek.

Without the month of December for 1913 and from January to June inclusive for 1914, Snake Creek precipitation as compared with my Exhibit 145 shows an increase of nine-tenths of an inch.

For 1915 the precipitation from December to July inclusive
310 for Snake Creek was 14.44 inches. Exhibit 145 for the same months shows that at Heber it was 10.5 inches, an excess in Snake Creek of about four inches. Of the same months for the year 1916, the precipitation of Snake Creek canyon was 18.81. Exhibit 145 [show*d*] the precip*ti*ation at Heber to have been 11.75; an excess in Snake Creek canyon of 7.0. For the year 1917 the precipitation of Snake Creek was 19.3 and the precipitation for Heber, shown by Exhibit 145, 12.6, an excess in Snake Creek canyon of 6.8. The precipitation of Snake Creek canyon as shown by the record is 30 per cent more for the last three years than at Heber. The data upon which I gave an absolute and unqualified opinion was not the best data available for the last four years.

The precipitation for twelve months, commencing July 1, 1914, and ending July 1st, 1915, in Snake Creek was 20.35 inches; commencing July 1st, 1915, and ending June 30th, 1916, 27.23 inches; commencing July 1st, 1916, and ending June 30th, 1917, 36.70 inches. I cannot indicate the last data on Exhibit 145. It would run off the map.

I did not include upon Exhibit 145 the months of July to November inclusive. If I said I did not include them because that was precipitation which did not stay there and did not add to the flow of the stream during the next year, I was putting it a little stronger

than I intended. What I meant to say was that it had not the influence that the winter precipitation had. I did not intend to convey the idea that the fall of snow in October and November, 1916, had no appreciable influence upon the run-off during the spring of 1917. I mentioned it did not have as much influence as the other months, and I did not consider it at all on Exhibit 145.

Exhibits 184 and 185 received in evidence.

Exhibits 153, 154 and 155 are duplicates of Exhibit 1. The scale of the country is 1,000 feet to the inch and I have depicted the flow of the rivers there on a scale of one inch to 50 second feet. That represents the quantity of flow and I have also represented the quantity of flow by arrow. There is no scale to the size of the arrow; there are two sizes; one for large flow and one for small.

Three of the main fissures cut across that area and are laid out in brown; they are on the scale. The dip of the fissure is shown by the width of the brown. The face of the Daly dips a thousand feet in a little less than 2,000 feet and the Back Vein about 700 feet in 1,500 feet.

311 These arrows and fissures were put on the three plats representing the years 1910, 1914 and 1917 to show the extension of the workings and just in a general way the quantity of water. It was not intended thereby to convey the idea that the more water there was flowing from those workings the more there was flowing in Snake Creek; they were entirely independent

Exhibit 153, 1910 does show the lesser flow of Snake Creek than the other two years and the arrows on 153 do indicate a lesser flow for the other two years and the same thing is true when you compart 1914 with 1917. There was no intent in that. They represent the conditions as they were, or as they would be in 1916. The year 1916 is not shown at all, so there is no place for that remark there so far as these exhibits are concerned except so far as it is intimated that choice years were taken.

By those exhibits it is not intended to show that those workings actually take water from Snake Creek. They take water from the Snake Creek water shed but whether or [*nor*] from Snake Creek I do not know. There was no intent to show that those workings either increased or decreased the flow of Snake Creek; just the intent to show the conditions only, not to draw any conclusions.

The purpose of these exhibits is to show that these workings are actually taking water from that area, and at the same time show the different main streams of Snake Creek and allow the court to have an opportunity to get a view of their general relation to each other and draw his own conclussion. It is not my judgment that the Park City workings shown on Exhibit 15*r* actually take water that would otherwise flow in the Snake Creek drainage area.

The water *is* the Daly fissure as well as the Black Vein has come from a southwesterly direction. It is determined by the fact that as the headings advance to the southwest they become very wet and the headings on the northeast side dry up; consequently the water coming down those fissure walls and letting into the fissure must come from the Snake Creek area.

The relation as to the actual flow of water in Snake Creek and its tributaries, as shown upon the map and in the Daly Judge workings and the fissures, in quantity sought to be demonstrated by Exhibits 153, 154 and 155, is the possibility that some of the water which has entered those streams may now be coming out through the Judge workings. It is not an attempt to demonstrate that from
312 those tunnels and those workings water is now flowing which formerly flowed into Snake Creek and its tributaries. It is only made as showing that possibility.

Exhibit 186 received in evidence.

My exhibit 145, as to each year shown thereon leads up to July 1st and there stops. It is just a period of six months.

Exhibits 153, 154 and 155 so far as they refer to the flow of Snake Creek, show the date of July 1st in each year. The flow of the streams on these three latter exhibits for the years 1910, 1914 and 1917 on July 1st is intended to be expressed with reasonable accuracy, on a scale of 50 cubic feet to one inch in width. We have no actual measurement of the water flowing [*flowing*] from the Daly Judge workings shown on 153 on July 1st, 1910. It is a fact, as I have stated, that I placed on Exhibit 153 a definite quantity by measurement as to Snake Creek, and an unknown quantity by measurement as to the workings of the Daly Judge shown on the same exhibit. I cannot give the actual measurement of water flowing from the Daly Judge workings shown on Exhibit 154 on July 1st, 1914. I have compared on that exhibit actual measurements of the flow of Snake Creek on July 1st, 1914 with an unknown qauntity of flow from the Daly Judge workings on the same date. And the same state of facts is true in regard to Exhibit 155 with reference to the measured flow of water as indicated in Snake Creek and as indicated in the Daly Judge Workings.

There were several things I wanted to show on Exhibits 153, 154 and 155. First, it was as to the deceptiveness of Exhibit No. 1, as giving a wrong idea as to the sources of the surface springs and the amount of water they carry. On this exhibit, some of the very small streams are made quite wide and coming directly over the tunnel line. While it was only brought out to represent drainage areas, still the general impression, looking at the map, would make it appear to be stream flow. The stream lines are put on these exhibits so as to correct any such impression that may be gained from No. 1. I know that several pages of testimony were devoted to an explanation of Exhibit 1 and that it was stated flatly by the defendant and its witnesses that Exhibit 1 merely represented depressions between the elevation and ridges, except as marked with streams, showing where streams flow, and that it was not intended to represent the height or width of the elevation or the width of the depression or stream flow.

The volume of the stream flow on July 1st of any number of series of years would in all probability [*by*] different for each
313 year.

The second reason for making Exhibit 155 was to show the position of the Judge workings under the flat which were taking

water at that date, and to permit the court to have an opportunity to have an optical view of their relative positions with the Snake Creek drainage area and draw his own conclusion as to the effect that those workings would have upon drawing water from that area. As to that proposition, the volume of water flowing in Snake Creek would not be a factor in any way.

The diagramatic representation of the flow of Snake Creek on Exhibits 153, 154 and 155 does not form a part of the purpose for which these exhibits are made as I have detailed as to its second purpose. At the same time, for purposes of comparison, the volume of flow was marked on those streams to better enable the Judge to see their relative flow, and I have asked the court to make a comparioan between a known measured flow of Snake Creek on a given date with an unknown flow as to measurement on the same date.

The third [purposse] of the [exhi-t*is*] was to better show the court the relative size of the tributaries to make Snake Creek and the relative amount of water which was coming out of the Snake Creek tunnel.

Q. That purpose was not served in any way by combining the Daly Judge working with the Snake Creek flow, was it?

A. No.

Mr. MacMillan: We refuse to be bound by that answer; Mr. Friendly is not the plaintiff. Counsel representing the plaintiff has a right to draw his own conclusions from that. We assert at this time that it does have a bearing.

The Witness: Starting from the irregular shape enclosed by yellow on the exhibits 153, 154 and 155, marked "Midway Reservoir", there is a line following down towards the bottom of the map marked "White Pine". That is intended to represent, with relation to Snake Creek, the quantity of flow of White Pine at that time of the year.

We have no measurement of White Pine on that date. I have no measurements of lower Snake Creek on that date. I do not know by any measurements made on July 1st whether there was any water flowing in the left hand fork of Snake Creek, nor do I know by any measurement whether there was any water flowing from Twist Spring on that date. Neither do I know by measurement whether
314 there was any water flowing into Snake Creek from Gerber Spring upon that date. I made no measurements of water flowing into Snake Creek proper between Snake Creek tunnel and Mountain Lake tunnel on July 1st, 1917. I had no measurements of lower Snake Creek just opposite the town of Midway on that date. So then, that data is not accurately expressed on Exhibit 155 for the reason that I have no data in regard to that.

In regard to Exhibit- 154 and 155 referring to the stream of White Pine, to the left hand fork of Snake Creek, to the Twist Spring, to the Gerber Spring, and to any flows between the Mountain Lake tunnel and Snake Creek tunnel and lower Snake Creek near the town of Midway. I have no measurements for any one of those places for July 1st, 1914, and the same is true as to the same streams for Ex-

hibit 153. It was my purpose and I had in mind as an inducement for making Exhibits 155, 154 and 153, that the picture itself showed, or was persuasive of the fact, or was the foundation of an inference, that the flow of water in the Daly Judge workings decreased the flow of water in Snake Creek on any given date in any year. There is no foundtion for such inference on the map without relation to the other exhibits.

I intended to express an opinion that, in my judgment, it was highly probable that the water now flowing, and which has flowed heretofore out of the workings of the Daly Judge, as shown upon these three exhibits, formerly found its way into the channel of Snake Creek or its tributaries, and that the waters now flowing out of the Daly Judge workings are waters which, if it were not for the Daly Judge workings, would in whole or in part and did in whole or in part, before the workings were made, find their way into Snake Creek and form a part of the waters that flowed down to Midway. And yet, I said in answer to counsel in direct examination that in my judgment, the Snake Creek tunnel, when it was two miles long and two miles away from the Daly Judge workings, had added to the flow of Snake Creek all the volume of water that flowed out of the tunnel and by that I meant that the flow of Snake Creek below the portal of the tunnel had been increased in volume ever since water flowed out of the tunnel to the amount in volume of water flowing out of the tunnel.

I reconcile the two opinions by the fact that in the face of the Park City workings we had wide-open fissures coming right to the surface in that area and fed by the beddings to the diorite
315 in the face of the Snake Creek tunnel turning into Snake Creek; I refer to Snake Creek itself at that point. Now it is entirely possible that some of the water which is coming out of the tunnel, though a very small portion if any, and an amount which cannot be measured in the creek, has percolated out into Snake Creek basin or in any other basin. In other words, I do not mean to be understood as saying that none of the water which has flowed out of Snake Creek tunnel since water did flow out, never found its way into Snake Creek at some portion of the course of Snake Creek. It certainly is not as probable that the waters flowing from Snake Creek tunnel or some part of it found its way into Snake Creek as it is that the waters now flowing from the Daly Judge workings found their way into Snake Creek.

I have means for determining the quantity of the waters which have flowed from the tunnel which would have found their way into Snake Creek had it not been for the driving of the tunnel. Those means are the various water measurements which have been introduced in evidence. That is the foundation upon which I give my opinion. I give the square, far-reaching opinion that none of the waters which have flowed from the tunnel would have found their way into Snake Creek if the tunnel had not been driven. I do not mean Snake Creek clear down as far as the Midway Company take water. I have already stated that I think it entirely possible that some of the waters which are coming out of the tunnel may have at

ome prior date percolated into the Snake Creek drainage area, but give it as my opinion that that quantity is practically a negligible quantity. I have measurements only for recent years of the total low of Snake Creek that has been available to Midway Irrigation Company for the irrigation of substantially 3,500 acres of land irrigated from Snake Creek, upon which I base the opinion I have just given.

The last total measurement was on May 23rd, 1918. The total flow was 41.93 second feet. The next prior measurement was October 1st, 1917, total 49.98 second feet. The next prior September 30th, 1917, total 50.85 second feet. The next, August 6th, 1917, total 41.28 second feet. The next November 2nd, 1916, total 32.08 second feet. The next as expressed on Exhibit 157 was August 28th, 1916, a total of 41.94 second feet. The next July 29th, 1916, total 35.82 second feet. The next August 11th, 1915, total 29.28 second feet. There is expressed on Exhibit 157 eight additional measurements to what I have detailed. I have one prior measurement to July, 1915, that of November 29th, 1914, total 30.06. That
316 was a measurement of all inflowing streams, and was not the same character as the other measurements. We did not measure the amount of water that was actually flowing out of Snake Creek into different ditches and down to the different ditches as the other measurements did. As far as measurements of the total flow of Snake Creek are concerned, those are all I have.

It was the intent and purpose of Exhibit 157 to show the relation, as to the quantities, of the whole flow of Snake Creek with the flow of Provo river as shown by the United States Reclamation Service Report for the times in the year shown on Exhibit 157, and that includes nine measurements in 1915 and two in 1916. If it shows the relation as to quantity, of course there would be a percentage relation between the two.

Exhibit 156 diagramtically shows the quantity of flow of Provo river. That was taken from the report of the water surveys of the United States and the comparison gives the comparison of quantity of flow of Snake Creek by Call and Barzee's measurements with the quantity of flow of Provo river and is the same character of quantitive comparison as the quantitive comparison of 157.

By picture comparison of Exhibits 156 and 157 it was not intended to show that the quantity of relation between Call's measurements and Barzee's measurement was greater than the quantitive comparison of our measurements, both with Provo river. It was intended to show they were irregular measurements, in most cases where not subject to other conditions, in excess. That was the intent of the exhibit, but that intent has another basis. That intent was based upon the assumption that Mr. Wentz had advanced the theory that there was a constant ratio between the flow of Snake Creek and the Provo river.

Exhibits 145 and 148 can be used as companion exhibits and I used them in that way in my testimony.

Q. Your intent, as I now understand, in preparing these exhibits was to show that on the 1st of July ordinarily the high water flow,

that is quantitive high water flow, I don't mean peak, was relative to the precipitation for the year or for the six months of the year you have taken?

Mr. MacMillan: May it be understood wherever he asks this witness if it was his intent in preparing these exhibits, that my objection
goes to that upon the ground it is incompetent and not cross
317 examination, and the ruling will be the same and that I have
an exception?

The Court: The record may so show.

A. Within very broad limits, yes.

The Witness: Taking the two exhibits together, there is nothing else that can be deducted or inferred from them.

If we were to make a similar diagram to 148 for one entire year, we would have a different diagramatic representation as to lengths and therefore indicated volumes of flow of Snake Creek and Lavina Creek for practically every day in the year, and whatever variation there was in the tunnel, that would be shown. If we were to prepare a similar diagramatic representation for every year, either before or since 1911, if we had the data, it would be a chance if any two of them were alike. If we take any month or any year, a line connecting the right hand projection would be somewhat different in shape. In other words, the curve of the flow for July 1st would be somewhat different for each and every year, and to a certain extent each and every day in the year would be different.

I draw the comparison between exhibits 145 and 146 that the extreme flow seems to be influenced to some extent by the precipitation, in other words, Mahogony Springs, as to volume of flow, is in some proportion related to the precipitation, rises with the rise of precipitation and falls with the fall of precipitation, within limits of influence, but that is not the total factor, it is one factor.

Exhibit 147 goes back to 1900 and purports to indicate the aggregate flow of Snake Creek and Lavina Creek opposite the tunnel and on its face there is no relation, one year with another, except the quantitative flow of one year and another. In my opinion there is no other inference to be drawn from Exhibit 147 itself, except the comparative flow, one year with another.

I said that the measurement of Springer Spring of 1.28 second feet was not a clerical error. The next lowest measurement I have of that spring is 2.11 second feet, a difference of .83 of a cubic foot per second between the two or about 40 per cent lower than the next lowest one. As an explanation of this difference I cannot account for it and I think there must be some error or some unknown condition present, because six days later there was a measurement of the
same spring and it goes 2.2. I cannot account for it on any
318 other reasonable basis. It would be reasonably supposed that
a man of good fair ability could not get that divergence in measurement without some mistake somewhere. There was evidently something wrong, but I cannot account for it. The only way I can account for it, would be a mistake in the setting down figures or in some computation.

There are other measurements that are factors in making up my opinion that none of the waters now or which have flowed from Snake Creek tunnel ever before the driving of the tunnel, found their way into Snake Creek. There are the measurements of Captain Springer and the power increase which is not yet in evidence. There is nothing else in the way of measurements.

As to the total measured outflow of Snake Creek, I have nothing to compare with these other measurements earlier than November, 1914, and that was three years after water had commenced to flow out of the tunnel in an appreciable quantity.

After the surface flows are gone and in the absence of rain the volume of water flowing in every stream in this arid country depends on the water content of the underground tributary area to that stream. The record shows practically 100 days of precipitation in Snake Creek canyon. Assuming there was absolutely no stream except what was furnished by rains during July, August and September, I do not think there would be a steady stream of water in Snake Creek. It would not form a stream that could be depended upon for irrigation, power or anything else. So then, a dependable stream in Snake Creek, as well as any other creeks in this country, depends upon the quantity of water that is in the ground from which the source of supply of the creek may be drawn.

Mr. Boutwell uses the term "master drainage depression" in the sense of the main avenues or canyons in which the streams run. As to Park City, the master drainage depressions of that section of the country are McHenry's canyon, Thayne's canyon, Woodside Gulch, Empire Canyon and Ontario Canyon. Thayne's canyon runs northerly or parallel with Empire canyon and White Pine canyon. That is another one that connects with Thayne's canyon, and Iron canyon I believe they call it, just west of Thayne's canyon.

I understand that the "tributary area" to a master drainage depression is the area whose drainage duns into the master drainage depression, providing that drainage comes to the surface in that area.

319 If it does not come to the surface I would not call it tributary.

I recognize that refilled canyons carry sub-surface streams at times—several of them. I recognize that the voids in the refilling of a canyon must be filled with water in order to support the sub-surface stream, unless they are covered over by an impervious material.

It is my professional opinion that the refilling of some of the refilled canyons in this country carry a little water; I do not recall any that carry immense quantities. I am not informed as to what developments in regard to ground water levels of the State of Utah in the places you mention have shown as to underground flows of water, I do not know about those things.

If we have a canyon the refilling of which was full of voids and the canyon carries a surface stream and the melting snows are gone and there are no rains, the water in the refilling of the canyon would come from the sub-surface tributary of that drainage depression, so it is not necessary for water to come to the surface in order to come from the tributary area of the depression.

During the noon recess I have looked up the question we were discussing this morning about the presence of water in the earth crust. I know that estimates are made on five per cent. I think that is about right. Some estimates are much higher and some lower; I think Van Heiss gives two and one-half per cent as a general proposition, and I think that is about right.

All of the country shown on Exhibits 115 and 139 north of the dividing ridge between Park City and the Snake Creek side, is in my judgment tributary to the master drainage depressions on the Park City side.

In my judgment there are master drainage depressions in the sense that Boutwell uses the term on the Snake Creek side. The main Snake Creek canyon, White Pine canyon and also Lavina canyon.

Speaking broadly, the whole of Snake Creek down below the mouth of the canyon, I would say was a master drainage depression. Snake Creek and its tributaries and perhaps we might sub-divide that into master drainage depressions for those localities I have indicated and the west fork of Snake Creek in a lesser degree.

320 I agree with the statement of Mr. Boutwell, made on page 102 of Professional Paper No. 77, where he says, referring to the time that mining development was commenced in Park City: "Evidently the ground water level in this district was high," with one exception. That exception is a piece of territorial area around Clayton Prak stock. There I say that the ground water level was comparatively low. Regarding another sentence on the same page of the same book, "From the main divides it descends beneath and accordant with the surface and re-appears at the master drainage depressions,"—referring to this language [any] my prior answer, the ridge between Snake Creek and Lavina Creek is one of the main divides. In a general way I agree with him that from the main divides it descends beneath and accordant with the surface and re-appears at the master drainage depression. I mean by my answer next prior to the last, that if a cross section similar to the one I have shown on 173 was cut across the country that it would show a depression as to the water table in the diorite under the peak and under the ridge line.

The most serious difficulty that miners met in their operations at Park City was the great quantity of water found at [shallow] depths. I agree with Mr. Boutwell when he says: "This region"—referring to the Park City region—"is subject to heavy precipitation, and the rocks, eespecially the red shale and massive quartzite, hold water in great quantities. In certain parts of the territory there was so much water that it was practically impossible to carry on mining operations in the early days to any great depth. As early as 1881 the Ontario mine took steps to overcome the difficulties of large quantities of water near the surface. As early as 1881 they constructed a tunnel at the 600 foot level known as the No. 1 drain tunnel." I bring the tunnel up to date on Exhibit 115. It is marked "Ontario Drainage No. 1". It runs from Park City to Ontario No. 3 shaft, which I have indicated by a cross; thence through

the Daly No. 1 shaft; thence to the Daly West mine shaft; thence to the Anchor shaft; thence on to the southwest into the Judge property for a distance of about 1,500 feet. Very shortly after 1881 it was completed to the Daly shaft. As early as 1885 that tunnel extended up to within a quarter of a mile of the crest of the ridge dividing the Park City and Snake Creek districts and has continued in existence ever since that time.

On page 25 of Professional Paper No. 77 Mr. Boutwell says in relation to that tunnel: "This tunnel effectively drained the adjoining ground to a depth of 600 feet." That is not true
321 as to the immediately adjoining ground to the depth of the
tunnel. It did not except as indicated by artificial channels, except as the artificial channels themselves affected the ground water, it had a very small impression and very localized. I know of one major case where the tunnel would not drain the ground 20 feet. I absolutely and entirely repudiate what Mr. Boutwell says that this tunnel effectually drained the adjoining ground to a depth of 600 feet. From my actual knowledge, it did not lower the ground water an inch or a foot in the country adjacent and adjoining except in a very localized sense, that is within a very small area, not worth considering. I will say that I mean by "very small area" throughout the entire area of the Ontario mine property limit. Giving it in feet or rods, I know in some cases that it did not do it 20 feet; there may be some cases where it is a few feet more, but I do not know of any case where it was over at the maximum of 300 or 400 feet.

If you consider the tunnel independent of its artificial branches it would draw some water out of the territory. I never said that it would draw practically no water, because it will cut through practically all the major faults on the northwest side. Water did flow out of those faults but it did not lower the ground water materially. I mean by "materially" that above the tunnel some mines working on the surface still found water near the surface. The fact remains that I repudiate in total the statement on page 25 that this tunnel effectively drained the adjacent ground to a depth of 600 feet.

After the Ontario mine had drained that water at the lower depth they did not have to do any pumping above the 600 foot level, they let gravity do it and relieved their mine of water.

They commenced the construction of the Ontario drain tunnel so-called in the early 90's and it was completed in 1894 as far as the Ontario shaft No. 2, that was 24 years ago. In the early days the Daly Judge was also troubled with water. They commenced a tunnel in 1884, in 1888 it ran to the Anchor shaft and discharge into Empire Canyon about one and one-half miles above Park City, it really went under the divide, that is it joined on to workings that went under the divide and water has been flowing out of it ever since, and in considerable quantities, and in my judgment did not lower the level of the ground any. Ground water is just as high as it was when those two tunnels were driven. She is right al-

most on the surface. The Ontario drain tunnel No. 2 is 675
322 feet lower and the Daly Judge tunnel is substantially 600
feet higher than the Snake Creek tunnel.

The statement of Mr. Boutwell on page 102, referring to the ground water level where he says: "This level"—that is the ground water level—"after the escape of enormous quantities of water, has been lowered above the deeper workings to a depth of 1,500 feet;" is absolutely wrong and his further statement, "and has been modified accordingly in tributary area," is absolutely untrue. I disagree with him entirely.

On page 101 of the same book it is stated, "At the time of visit water was rising above the 2,000 foot level; at the 1,700 foot level and the 1,500 foot level whence it issues constantly in great volumes." We are talking about the Ontario, that is true.

On page 102 he says: "Exploration in the early days in adjacent ground"—that is ground adjacent to the Ontario, "on the east showed an immense amount of ground water present at comparatively shallow depths." I think that is right. "Work in the Hawkeye, Lowell, McHenry and New York mines was stopped repeatedly by uncontrolled water." That is right. "After the deeper tunnel had drained this ground no further serious difficulty with water was experienced." As to this he is absolutely and flatfootedly wrong. The tunnel did not drain this ground and they had trouble right along as they had before and have it now. At first the Silver King within a certain area and within a certain depth encountered very little or no water. In the same formation and in the same locality they had a lot of water. "When the Silver King undertook deep mining the ground water level was not encountered; in fact it is reliably stated in sinking from the collar to the bottom of the 1,300 foot shaft not a drop of water was pumped." That is true. "At the time of the visit the mine was entirely dry throughout." That is the old Silver King; that it not what is now known as the Silver King because what is now known as the Silver King had water at that time. The old Silver King was in the Woodside shales on their very top level and they went into the Park City series, and thence into the Weber quartzite. The Woodside shales were dry until they got down aways. When they were in the quartzite aways they got a very bad ducking. By "aways" I mean coming in on the 1,300 foot level. That level is about 600 or 700 feet above the Ontario tunnel level.

On the same page Mr. Boutwell says: "In ground adjoining
the Silver King on the northwest, the Silver King Con-
323 solidated Company sunk a shaft in red shale which en-
countered a great flow of water." That was not the same formation I have detailed as to the other, but that shaft later went through shales into the Park City series and came right to the contact wi-h the Weber quartzite. I do not agree with him at all when he says: Q. "This, however, was clearly a local occurrence, resulting from the well-known habit of shale to retain water." I absolutely disagree. We have proved it false.

Referring to page 25, he says:—referring to McHenry and Hawk-

eye workings in McHenry's canyon and No. 1 and No. 2 shafts of the Ontario and in Ontario canyon—"The struggles in those early days against the water seem almost incredible as on the levels which were then so wet, one finds now only dust." That is very true; certain spots just on the upper levels of the mine; on the lower levels those mines are all now comparatively drowned out and they had to cease operation on the lower levels because they could not handle the water.

As a rule, the workings above the tunnels in the Park City mines are dry compared with what they were only in the northeast area. The were so wet you could not work in them.

The tunnels carry away water and large quantites of it. The relieve the workings of water and carry away water and yet have not lowered the ground water at all except in spots. Some of the tunnels on the Park City side have, the southwest tunnels on the Judge property and the Daly West property were at the time, 17 years ago, when that report was written, just started to get in their work of draining the northeast area. At the time that report was written, Boutwell had not the opportunity to observe the cause of this drainage. What I have now actually shown has happened then and has since happened in a very much more marked degree, is that the continued workings to the southwest of the various mines has drained the water of the northeast side to some extent only, but in very limited areas, and only in areas along these major faults where they were working. In the same way the southwest workings of the Judge property, working along the main faulting zone is gradually draining their northeast workings. Consequently was the West not working, the Ontario would be wet today; were the Judge not working the Daly-West would be wet today.

A tunnel driven into that district on the Park City side has absolutely no effect whatever upon the level of the ground water. The effect of the tunnel itself is probably to lower it in a
324 very localized zone to some extent. The Ontario tunnel has been flowing 12 or 13 second feet. The Daly Judge tunnel, the Alliance and the Silver King tunnels have been flowing for years, all carrying water. The ground water level was a certain height when they were individually constructed and the series were constructed. I cannot tell to what extent these tunnels have lowered the ground water because of their indirect influence on the other workings in the mines which feed them.

A tunnel driven into a sub-surface drainage area does not of necessity lower the level of ground water, in other words, you can drive your tunnel into the Park City side of this range and in some cases not lower it at all. There are some localized cases where it is lowered by the workings of the mine.

The area on the Park City drainage side, lying north on the right between Summit County and Wasatch County is about six square miles. With all the tunnels there are there, the ground water level has been only affected as to one square miles, and that is not in

one unit; that is in spots. The dropping of the ground water level is appreciable in one place; the area which is entirely honey-combed by the Ontario workings, fifty miles of tunnel in a very short area.

On the same theory I have said these tunnels we have referred to on the Park City side have no appreciable effect in lowering the ground water, and contrary to the statement of Mr. Boutwell in that regard, I predicted the statement I made in regard to the Snake Creek tunnel, that no appreciable amount of water that flowed out of the Snake Creek tunnel was water that did theretofore flow into Snake Creek.

The tunnel is dug into the ground with its portal between Snake Creek and Lavina Creek, near their confluence with three channels, the natural channel of Snake Creek, of Lavina Creek and the artificial channel of the tunnel, making the shape of a fan at the surface. My judgment is that if the ground water has been lowered (by the tunnel) it has been lowered to such a small degree that we have not been able to detect it in the area. The means of detection I have are, various springs and weir measurements and various data which we have already introduced. I predicated that statement upon the fact that the testimony that springs have dried up is false. In some cases I am making an assumption in that regard as all the springs referred to as being dried up would have affected the flow
of Snake Creek and Lavina Creek at the points in which
325 we measured, and we unable to see that they had decreased
our measurements.

Without there is a series of measurements covering years, and practically continuously throughout the years, and observations of evaporation, I think we can tell from measurements if there has been any appreciable influence as to facts I am testifying to now. The history of this country as to the flow of streams in volume shows that they are very irregular. There is no approach to recurrent regulations or cycles unless an entire general view is taken over a period of years. That general view shows that there has not been any decrease that we could detect. I do not remember what the general cycles throughout this area are. I think I have heard that there is assumed from the data to be one great cycle covering forty or fifty years. I do not know whether I have heard that within that cycle is another series of cycles running eight to twelve years as to similarity in high water and low water. I do not know anything about that.

We have dug one tunnel in the Snake Creek area that I say has no influence upon Snake Creek. If we dug another one it might have a little influence, so might this one have a little, but we are unable to find out. In my opinion you might run a dozen tunnels in there without affecting the flow of Snake Creek, unless you hit some of the proper formations for feeding those springs.

I have an opinion that we did not strike any feeder of Snake Creek in this tunnel. There are no major fissures in the length of the tunnel. The major fissures in the district are the Daly fissures, the Middle Vein fissure, the Back Vein fissure, the Jones fissure, the Cottonwood fissure and the Quincy fissure. They are all up near the ridge. I have seen no fissures lower down in the ridge than those I

mentioned. So then, you could run a dozen tunnels if you did not run them up near the divide, to cut those fissures, without effecting the flow of Snake Creek, in my judgment, unless they were run immediately under the creek and right near the surface, in which case they would be apt to drain the creek through some minor fissure or near the springs in the same way. They might lower the ground water to some extent and they probably would, but I cannot even [*d*ay] that for sure as we know that in the Park City district, that was not the case. I know it but Mr. Boutwell did not know it seventeen years ago, but as to whether he knows it now or not is quite another question. He came to the wrong conclusion. I would
326 not say that he absolutely misdescribed and missta*y*ed the
existing physical facts. I say that certain conditions which he said existed, do not exist there. I never said they did not exist at that time. I mean to say that they did exist at that time and have changed since that time. When those very properties got to really operating, they entered into the same condition that the Ontario entered into before she had her drain tunnel.

Roughly, there is now flowing from the Ontario drain tunnel, discharging into the Provo river, about 20 second feet; from the Anchor tunnel, described on 115 about four second feet; from the Alliance tunnel probably about four second feet; from the Hanauer tunnel one or two second feet; from the Union tunnel about one and from the Spiro tunnel about four second feet. The flow from these tunnels has been gradually increasing right along. The 35 cubic feet per second of water that I have named (flowing from the tunnels) has increased year by year with the extending in depth of the workings.

Certain of those fissures referred to on Exhibit 115 were filled fissures, they were filled with ore or something. Certain of them did carry water and certain ones of them did not. These fissures crosscut some of the gulches I have mentioned on the Park City side. There was a flow of water in these gulches where they crossed it, not coming from the fissures, it may have been coming from the fissures up above, I do not know as to that.

There was a little tream *or* water in McHenry canyon when I was there, not much. I do not know how much there was there before these tunnels were driven. There is a stream of water in the Empire Gulch in the low season, that is in Empire Canyon after the three canyons join. There is probably twelve second feet of water flowing; that includes the water from the tunnels. I do not know whether or not those canyons contained living streams before these tunnels were driven. I do not know whether the tunnels have effected those streams or not.

There is probably two second feet or more flowing in Ontario canyon. I do not know anything about what it was before these tunnels were driven. If these tunnels had no effect on ground water level, it would not be true that there should be as much water flowing in those creeks naturally as ever flowed there because that area was very heavily timbered and all the timber was taken out. That of

course, would change the stream flow; prevent quite so much
327 water sinking into the ground, but outside of that, if the tunnel workings had not lowered the ground water there would be just as much flowing as there was in the early days. I think there is about twelve second feet being discharged into the Empire Gulch after the three gulches join, something like that, which includes seven second feet of tunnel water. So in my judgment, five second feet is the total flow of the stream drainage at this time, the latter part of June. I am just giving an estimate, it may be a little different from that.

One of the tunnels I have spoken of discharges into Thayne's canyon. I have no information as to whether or not in the years before these tunnels were driven the flow in Empire canyon, below the confluence of the other canyons, in a year when precipitation and climatic conditions are similar to this year, and conditions for a couple of years or so before had been the same, was five second feet or approximately that. I do not know, except for the less quantity after snowfall has gone off by reason of the timber being taken away, that there is the same quantity of water flowing in those canyons, and in the one canyon after the three canyons join, as there was before these tunnels discharged water into them, leaving out the tunnels. I would not venture an opinion as to that.

I am not prepared to say that those tunnels have not affected the flow there. The level of ground water does not entirely control the flow of streams, except the surface run-off. It does to a very large extent; there are certain limiting factors. I know of exceptional conditions which exist through the Park City district which are some of those faults.

I do not know Dr. Fortier. I never read his books. I do not know anything about him at all. I do not know that he is a man who has made as extensive investigations as to water flow and water conditions and matters pertaining to irrigation as any man in the world. Now you mention that he is, and has been for a number of years, the head of the water resource department of the department of agriculture, I know of seeing his name in various Government papers. I agree with him when he says in one of his papers, "The seepage water of northern Utah by Samuel Fortier on p. 13," "The water contained in the open spaces occurring in clay, sand, gravel and other materials of which soils and sub-soils are composed is known by various names, such as soil moisture, ground water, and storage sub-surface supply and the like." When he says, "When this ground water moves down an inclined stratum of porous materials the term "seepage water" seems to be more appropriate
328 than that of ground flow which many writers have recently used. Seepage water conveys the idea of lateral motion, but when one uses the term "soil moisture" and "ground water" or "underground water" this conception is usually not implied." I understand it that way.

I agree when he says: "The water content in dry soils may be so small as to admit of only a slight vertical movement, due to the force of the capillarity and evaporation. On the other hand portions of

soils and sub-soils may be completely saturated, but so located that the water confined therein is stagnant." "In such cases there can be no lateral flow."

As he says, "Seepage waters as herein defined may be [regsrded] as coming from three sources, which however are not always distinct; (1) from uncultivated hillsides and mountain slopes; (2) from irrigated lands; (3) from the beds and side slopes of water channels." Those are the three factors.

I agree with him when he says: "It will be [readil-] understood that a complete determination of the quantity of water which comes from that which is stored on the ground in any particular drainage basin, involves more than a knowledge of the results of the stream measurements made in such basin." And yet I have stated that I based my judgment on the measurements made, after telling what they were and saying there were no other measurements involved, together with our geology and knowledge of the conditions.

I think the following statement by him is very true: "It is possible, for example, to ascertain with considerable accuracy the amount of surface water which flows into a valley the volume used in irrigation and the outflow, but without knowledge of the losses occasioned by evaporation, the problem of seepage of waters is indeterminable. For the want of such necessary information in relation to the precipitation and evaporation of northern Utah, relatively too much attention has been given to the surplus flowing in springtime and too little to that derived from ground storage."

Referring to what he further says: "A reference to Logan river may serve to illustrate the difference between that portion of the rainfall which rushes off the surface of drainage basins, either when snow melts in the spring or when cloudbursts occur in summer, and that which sinks into the porous covering of the mountain slopes to issue later as the flow from the ground storage maintaining the streams through the later summer and autumn months.
329 During June, July and August of 1893, the rainfall measured at the Experiment Station of the basin of Logan River was only one quarter inch. The snow on the mountain ranges had all melted before the end of July, yet, on the third of September there was a flow in Logan river of 250 second feet. Where did this supply come from? The slight rainfall need not be taken into account for it is safe to assume that an amount many times greater than the rainfall was evaporated. It could not have come from melted snow because the snow had disappeared as vapor, had run off or had sunk into the ground long before the expiration of the time named. The only available source was the flow from the ground storage; in other words, the seepage from the mountain slopes." I agree that a large portion of the water which maintained that 250 cubic feet per second of Logan River came from underground sources, it could come from nowhere else. Those underground sources are controlled by underground water to a very large extent, but not entirely. Within the same limit the same control is present on Snake Creek and in Empire canyon.

The following is stated by W. T. Lee in "Beaver River Water

Resources, Beaver Valley, by W. T. Lee, 817" "The waters of Beaver Valley are derived almost entirely from the Tushon Mountains and result directly from the heavy precipitation about the lofty peaks from which they enter the valley as streams. The rate of run-off from the mountains is regulated by the porous condition of the rocks, and by the accumulations of snow. The elevation is such that the snow which falls during the winter melts gradually and feeds the streams through the spring and early part of the summer. The loose volcanic tuffs and breccias absorb a large quantity of the water derived both from the rainfall and from the melting snows, and these waters are held back because of their slow movement through the rocks, and finally issue in the form of springs having a comparatively regular flow. This conservation of the water is of the greatest importance to the agricultural regions dependent upon the run-off," is true as to the general conditions of streams.

Assuming that there are faults, the Daly fault and Daly Judge fault and that they cross Empire canyon many times, there was a certain existing condition prior to the time mining was commenced there as to water flow, and whether the voids in the rocks which yielded up water after the snows had gone off were immense fissures or smaller openings, there was a fixed condition as to discharge from those openings and fissures at a time before these mining operations
were commenced; that the percentage of retardation of flow
330 by reason of the forests was a fixed quantity and assuming
that the cutting of the forest has decreased the percentage of precipitation sinking into the ground, I am not willing to express a judgment as to what extent the character of the flow of Empire canyon has been modified by the underground workings. And having no judgment, implies that I have no knowledge or basis for a judgment.

I stated this morning that the measurement of the total flow of Snake Creek on May 23rd, 1918 was 41.93 cubic feet per second. The flow of the Snake Creek tunnel at that time was 14.4 cubic feet per second. I gave another measurement as of October 1st, 1917, 49.98 second feet and the tunnel was flowing 17 second feet at that time. On September 2nd, 1917 the tunnel was flowing 17.5 second feet; on August 16th, 1917, 16 second feet; on November 2nd, 1916, 16.5 second feet; on August 28th, 1916, 18.5 second feet; on July 28th, 1916, 18.5 second feet; on August 31st, 1916, 17.5 second feet; on August 11th, 1915, 17 second feet. On July 9th, 1916 the hydrograph shows there was flowing from the tunnel 18.5 second feet; July 10th, 1916, 18.5 second feet; September 25th, 1915, 18 second feet; September 17th, 1915, 18 second feet; August 28th, 1915, 16.5 second feet; August 17th, 1915, 17 second feet; August 11th, 1915, 18 second feet; August 2nd, 1915, 17.5 second feet; July 22nd, 1915, 16.5 second feet.

From what I have stated as to my opinion that the tunnel to no appreciable extent has modified the flow of Snake Creek, then it follows—and taking my measurements of September 15th, 1915 and the water flowing from the tunnel, that there would have been, if the tunnel has never been built, but 10.72 cubic feet of water flowing in

ntire Snake Creek for the use of the Midway Irrigation Company or the irrigation of 3,500 acres of land on that date and on August 1th, 1915, if there is any basis for my opinion, there would have een flowing in all of Snake Creek down to the lower point of diverion for the irrigation of 3,500 acres of land, 12.28 cubic feet per second. Referring to the figures made upon the blackboard from the lata given by me on September 15th, 1915, there was 10.72 cubic eet per second of water in Snake Creek exclusive of the tunnel vater; on August 11th, 1915, there was 12.28 cubic feet per second in Snake Creek, exclusive of tunnel water and on July 28th, 1916, 17.32 ubic feet per second, exclusive of tunnel water.

Upon all the [knowledge] that I have in relation to the quantity of water flowing, if climatic and precipitation conditions
:31 were the same at any time in any year, as they were on or about September 15th, 1915, and had been for sometime previous, there would have been available, if the tunnel had not been lriven, according to my information, 10.72 cubic feet per second of vater for the irrigation of the lands under Snake Creek, and on August 11th, 1915, under similar conditions but 12.28 cubic feet per econd. With 3,500 acres of land under irrigation from Snake 'reek itself and with 10.70 cubic feet of water available for irrigaion, that would be 328 acres to a cubic foot per second, on that false ssumption. I say it is a false assumption because there are not ,500 acres of land irrigated from Snake Creek alone. A large porion of that is irrigated from the Provo river and from Ontario tunel water. I know about that from the testimony of your own (defendant's) witnesses. I absolutely do know of water going in rom the Provo and that there is water going in from the Ontario unnel by way of the Provo.

Q. But the amount of land that was irrigated you have no personal nowledge of?

A. No.

Q. And from your deductions of the testimony you say that my ssumption is false?

A. I am making no deductions from the testimony; I am taking he testimony as it was put in evidence, not deductions.

Q. You are very bitter in this case are you not?

A. Absolutely not.

Q. You are so bitter that you are willing to absolutely state to this ourt by way of an argument what the fact is with regard to the mount of land that is irrigated from Snake Creek?

A. No, sir. I am not at all bitter.

Q. You say that in face of your answers to me now that you are ot bitter?

A. Yes, sir.

Q. Whether you are or not, upon the assumption which I make, nd which you have no right to question in your answer, if there were 12.28 cubic feet per second flowing in Snake Creek available for the se of the Midway Irrigation Company and they were irrigating ,500 acres of land with that water, that would be 285 acres to the ubic foot per second, would it not?

A. Yes, that would be.

The Witness: And upon the same question, when there were 17.32 cubic feet per second flowing, there would be substantially 200 acres irrigated by one cubic foot per second of water.

In view of my answer that no substantial part of the waters now flowing in the tunnel ever found their way into Snake Creek
332 before the driving of the tunnel these facts in no way whatever shake my confidence in my judgment.

Exhibit 174 is my measurement, with notes, in regard to the flow of water in the tunnel. I made no notes in regard to the flow of water in the tunnel after it was in 10,555 feet. And that was the point that had been passed about fifty or sixty feet at the time of the last trial.

In Book G, page 14, my note is: "No open crevices over one-half inch wide." In the same book, page 16, my note is: "150 G P M running out of west side of fissure; about same amount from east side, crevice opened a distance of five feet from tunnel, then appeared to close." Again in Book G, page 16, I say: "Only a couple of open cavities exceeds one inch in width, and one of them about five inches," that refers to the width.

In Book G, page 19, my note is: "Flow 75 G P M, fissure seven inches wide at tunnel, closes to one-half inch at six feet." G-23 and 434 the note is: "Quartzite bed dipping 25 degrees northwest, cut by several small fissures which carry water; no heavy pressure when first struck; have since dried up; these fissures six inches wide at tunnel but close within a few feet." G-23, the note is: "Fissure trickling water, one foot wide at tunnel; closes to one inch at three feet on east side, at five feet on west side and at three feet in back." G-23, amongst other things, my note is: "Closes at one foot." G-37: "Opening three inches wide, five feet from wall of tunnel."

I do not know whether or not it is a fact that wherever I have made a note as to the character of the fissure back or into the rock from the tunnel, I have always made a note that it closes, I would have to look over and see.

I do not remember whether I found anything in the tunnel outside of thirty-four different items regarding the flow of water sufficient to note, I would have to check over my notes, I do not remember. There are thirty-four different notes but some of them are composite notes. That is all that occurred to me as worthy of note.

At [once] place we had a large flow of water and we were obliged to suspend work on account of the flow of water. That is shown on Exhibit 169 by the peak and perpendicular drop. From my notes here it was hit on October 11th at 11 p. m. and they were at work taking out sand three shifts until October 18th, after which
333 date one shift was discontinued and they only worked two.

I don't know exactly when the work of driving the face of the tunnel commenced again but on November 2nd they were forty-five feet past that point. Work was suspended in the breast for a time. While the work was suspended they were taking sand out of the tunnel and pumping, the sand came out of that fissure and flowed into the tunnel, we took out 2,573 mine carloads. The character of the sand was fairly fine, I should say that probably ninety per cent of it

would be ten mesh; one-tenth of an inch in diameter. These mine cars, as usually loaded, held about eighteen cubic feet. In round numbers that would be about 50,000 cubic feet, substantially equivalent to an acre of ground a foot deep.

After starting work in the face again there flowed from the mouth of the tunnel a substantially regular flow for some considerable time, as shown by hydrograph 169; about eight second feet until January, 1914, so then for three months there flowed from the tunnel about 8.5 second feet and work was practically shut down from October 11th until about the middle of January.

The fissure from which this water and sand came had a strike but I have not shown it upon any of the exhibits nor where we got the 2,500 carloads of sand. Roughly speaking, work was suspended upon the tunnel about the first of December, 1912, until the 1st of August, 1913. We struck this fissure and the flow of water at this fissure October 11th, 1912. The tunnel did not progress in its length for something like ten days while we were moving the 2,500 carloads of sand. The type of [sane] was of a general quick sand, I think it was disintegrated limestone or quartzite. The sand was carried in by the water and came from a little hole right in the breast 18 inches in diameter. The formation at that place was limestone.

We commenced work in the breast again in the last week of October and drove until the 1st of December of the same year, progressing 280 feet and then shut down until July of the next year.

The opening, which I described as 18 inches in diameter, crossed the tunnel, it was shown upon the right and left hand side going in, and in *in* the roof and back and on the floor. I have but a recollection of the width after we had progressed by and the 2,500 carloads of sand had washed out. As I remember water was coming in from all over; I do not think we could determine which side it was
334 coming from; it was just coming into the tunnel. I timbered it so I have never been able to tell whether it flowed from both sides or one side. There is nothing in my mind to show that the strike was pronouncedly different from the other fissures shown on Exhibit 139. There were a number of places where there was a small flow of sand breccia around the tunnel; this was the only place where we had any large flow. A few cars of sand flowed into the tunnel whenever we struck the larger flows and the larger fissures.

You correctly understood the testimony that the red lines crossing the tunnel were representations of the strike of those fissures which I spoke of and indicated in my notes and in Exhibit 174. If you put a straight edge substantially along the course of the strike of every one of them that I have shown and assume that the fissure extends laterally from the tunnel for a sufficient length, each and every one of them will pass under the master drainage depressions of Lavina Creek and Snake Creek with the possible exception of the one at 10,500, and that would cross Lavina Creek up very well near the top and possibly not cross it at all if it was continued, but would cross under the drainage area of the head waters of Lavina Creek.

Most of these fissures are nearly vertical or dipping a few degrees from the vertical. Water did not flow in any substantial quantity

in some which I have indicated and in some of them water did flow in great quantities.

I have not placed upon Exhibit 139 all of the fissure- that did carry water, in fact, there are very many other fissures "using fissures as a general term" that did carry water besides those that are shown upon Exhibit 139 and the companion exhibits.

Page 5 from Le Conte, old edition, says. "We find that all rocks, for reasons to be hereafter discussed, are broken by fissures into irregular, prismatic blocks, so that a perpendicular cleft of rock usually presents the appearance of rude gigantic masonry. These fissures or joints increase immensely the surface exposed." That satisfies me in referring to fissures and joints all in one.

After the first striking of water, after the flush of the strike has subsided, water flows into the tunnel from one side or the other or the bottom. I know of a very few cases where the flow would appear in the tunnel upon one side. Sometimes a flow would come out of these fissures from the other side. When we first struck it it would come from various heights above the floor, generally
335 from drill holes, it would come from some distance up the sides or from the top. After a time it would subside so that the flow came in at the level of the water in the ditch.

As far as these fissures were concerned, in February, 1915, all the [l-rger] flows from them were coming in from one side or the other at the level of the floor of the tunnel or the level of the water of the ditch, either from one side or the other or from the bottom, I think most of it was coming from the bottom. I do not mean to say that there was no flow from the right or the left, that it came from the bottom in the width of the tunnel. With the fissures striking substantially at right angles and the tunnel water flowing in the tunnel through the fissures the water of necessity approached the tunnel from the direction in which the fissures crossed it.

Referring to what was termed the prophyry sill in the other trial, which was the red which crossed the black splash representing the concrete at a very acute angle from horizontal which I saw for the length and width and height it was exposed in the tunnel—I am not sure about just how it was observed going out of the tunnel but we did observe it in the roof or back at first. I am not sure that it disappeared in the tunnel. The dip or course I do not know, except what we afterwards determined on the surface. Exhibit 169 does not represent what I actually saw any further than that it came in at the roof.

I did find an outcrop of porphyry on the surface near the portal tunnel. I do not remember the total distance in length that that outcrop appeared upon the surface in its strike, but for quite a little days along there we saw the outcrop; I did not follow it to its extremities, just enough to determine it.

I saw an outcrop of porphyry in three places. The outcrop I found nearest the portal is marked on Exhibit 115 at the green mark of the tunnel line about an inch from the portal. In my judgment we found that dike in its strike at the green mark an inch from the portal and again at the second point marked in green. Those

outcrops form substantially a semi-circle. It is my idea that that is the same intrusion I have shown and that it is continuous. It is my judgment that there is a change as to the contour line formed by the intrusion under the surface from what there is above the surface, that is, your outcrop of a flat bed intrusion may be in the shape of a horseshoe while your bed may be on a tangent, due to an
336 erosion which would give you the shape of the line connecting the outcrop.

I did not follow this so-called porphyry intrusion from the tunnel to the east. I just found outcrops of porphyry but we could see that they did extend to some distance on either side of our point of observation.

I do not know whether that porphyry intrusion came to the surface all the way along the course I have indicated on the Exhibit, I do not think it could, but it might, I think it would be buried. I do not know how far distant it might be under the surface at any particular place, at some [*places*] it might be one distance and in other places other distances, even if continuous. The fact that the so-called porphyry sill, where it crosses the concrete, and the outcrop on the surface near the portal of the tunnel are the same intrusion is a matter of opinion with me, but it is a matter of strong opinion, as at one place we were able to get the dip of the sill on the surface.

The porphyry dike which crosses the tunnel nearly vertical before you come to the concrete, is shown to approach the surface but not to reach it. I did not find it on the surface at that point. I found nothing in the shape of a fact to guide us in determining whether that dike went to the surface or where it went.

I found porphyry intrusions in Lavina Creek in two places. Where the porphyry crosses Lavina Creek its height is coincident with the level of the bottom of the surface stream of flowing water. Assuming that the porphyry intrusion which we found at Lavina Creek and at the tunnel is the same porphyry intrusion we have no direct knowledge as to whether it comes to the surface of the ground or how near it comes to the surface between the tunnel and the point where we find it in Lavina Creek. When a porphyry [intru*tion*] comes up it does not necessarily follow the slope of the country, it may come up very much higher in one place than another. It may come to the surface in some places and hundreds of feet below in others. If this intrusion crossed the country it would cross Snake Creek and of course has been eroded to the level of the bed of Snake Creek and then covered over. I found no surface outcrops between that and Snake Creek, so whether it runs from the tunnel to Snake Creek or not I have no positive knowledge or how near it came to the surface, if it came at all.

337 It is my idea that there is a porphyry dike extending from the tunnel and across Lavina Creek and that what I have projected as the sill and which I say outcrops at the surface above the tunnel is a sill. The two exposures of porphyry in the bed of Lavina Creek are about 900 feet apart. I class these two exposures as outcrops of the same intrusion but not of the same dike. In my opinion one represents a sill and the other a more nearly perpendicular dike.

I found porphyry shown upon the surface between the tunnel and Lavina Creek in one place, that is indicated in red. There is nothing upon the surface to show an absolute continuous line from the tunnel to Lavina Creek. We know it is on the surface at two different points. It appears at one place on the surface and at one place in the bed of the stream. How far below the surface it may be at different points between I do not know.

I show another porphyry dike about 4,800 feet in from the portal, approximately 2,000 feet from the other. It was not very thick, possibly fifteen feet. I found an outcrop which I attribute to the same dike. Those were the ones I have marked in red, as well as one additional one which I will now mark in red on Exhibit 139. I found one outcrop that I marked in red on the left or east side of the tunnel farther away from the portal on Exhibit 115. I will mark them with the letter "P," standing for prophyry.

That is the only surface outcrop I found. It was not perpendicularly above the tunnel, about 1,000 feet to one side. I do not remember how far I could see it on its strike on the surface but I think it was for some distance both on the surface and in the mine workings of Mr. Bogan. It has been for four years since I have seen it and I have forgotten. At the tunnel all I saw of it was where the tunnel cut through it and the red line running in the direction indicated above the tunnel towards the surface is merely indicating what I think exists there, and I did not carry it to the surface.

My idea is that the porphyry dike at about 2,800 feet and the porphyry still is a dam and that it extends across the country in a general east and west direction. I would not say that it crosses all the surface drainage depressions within the surface area of Snake Creek. I would not say how far it goes on each side. I have
338 a very strong opinion, that is a conviction, that it comes to the surface all the way across, except where buried by alluvium or hidden by vegetation. It would not project above the rock formation and the rock formation on a cross section easterly and westerly across this drainage area would be very irregular as to height, but up to its height and down to its depth in my judgment it was a dam to prevent water from flowing to the south, except where it was crossed by junior fissures.

It may have been crossed by junior fissures. I don't know but one place where I could say it was so crossed but there may be others, water would flow through those for some time until the porphyry again sealed them. My idea is that all water which lay to the north or back of that porphyry dike could not flow to the south in any way whatever, unless it flowed over the top or through a junior fissure and which latter flow would be merely temporary, very little water would pass through it.

I don't mean to say absolutely and positively that this porphyry dike and sill showing near the cement (in the tunnel) is an absolute dam to the passage of water down south and west; some water gets through it. It is relatively a dam. As to quantity of flow of water past it I have no means of knowing how far it is absolute and how far it is relatively a dam.

The situation as I have depicted it on 169 is substantially the same as 2,800 feet as it is at forty-eight or forty-nine hundred feet. The dike at substantially forty-eight or forty-nine hundred feet from the portal would have the same general effect as a dam, as the one twenty-eight hundred feet from the portal, as to flow of water to the south or southwest.

I have put those two porphyry dikes on their strike on Exhibit 115. The second dike is red, the sill is green. I simply infer that these dikes continue to the west or southwest. I have not followed them.

The water we encountered between the porphyry sill in the neighborhood of 2,900 and the second porphyry dike was absolutely not entirely separate and independent from the water we encountered beyond the second dike. If both of these porphyries are dikes, in a state of nature, before nature was broken up by our tunnel in her habits, that would not be an entirely independent flow under the facts I have detailed that the water flows easterly and westerly through these fissures, if there is anything in my theory that the porphyries are dams. It is not a dam and a dike as to the
339 first intrusion from the portal and not a dam and a dike to the flow of water so far as the second entrusion is concerned, they both act as dams in a general way. I express absolutely, without qualification, that so far as any substantial quantity of water passing south or southeasterly of the first dike and porphyry sill, that sill and dike are a dam, as shown by our tunnel hydrograph. The first dike was a more completer dam at the point where the tunnel crosses than the second dike but they both acted as dams in a general way. I have never inferred that the dike and sill, shown 4,800 feet from the portal, was a complete dam in the sense that it let nothing through it,—I said so far as the passage of any substantial quantity of water is concerned. In my opinion the second dike at 4,900 lets more water through it. They are both porphyry dikes; both cut by the tunnel and both cross the tunnel at substantially right angles. As a dam, in my judgment, the second or 4,900 foot porphyry is in no comparable per cent as efficient as the first.

We found in large quantities between the two dikes and found larger quantities beyond the second.

We did not find water up against the porphyry sill, the material was simply moist. The dike was not very badly disintegrated but the sill was more so. I cannot answer what part of the dike was the least disintegrated. As to which side of it as we drove the tunnel was the more disintegrated I cannot answer. As to the dike itself I do not remember, but the sill was very badly disintegrated. I do not remember which part was the more disintegrated, the part we approached first or the part we passed through last. I do not remember any difference at all.

There was no water within 270 feet of the porphyry sill or 370 feet of the porphyry dike at the time the tunnel crossed them, and when we found water we found it in a fissure in hard, solid black lime. That was a fissure. That crossed the tunnel diagonally and it projected and crossed Snake Creek and Lavina Creek. The black

lime was solid between the cement and the fissure; water did not flow through it. That fissure yielded about five second feet of water at its maximum, almost immediately that flow became reduced to between two and three second feet, within less than two weeks; how much less I do not know; then we had a flow of substantially 2.25 second feet for something over three months.

340 When our tunnel struck that fissure the water was there. We did not have to wait for the water to come. There was no suction about the tunnel and that was in the Snake Creek drainage area both surface and sub-surface, and the water flowed from this fissure into the tunnel which was in the Snake Creek drainage area and has continued to flow in an opening between the rocks which had width and it flowed with velocity.

For a period of three months we had substantially 2.25 second feet. After the three months we had substantally five second feet flowing for three or four months. We struck a fissure which yielded that additional two and one-half second feet. It came from the fissures and the beddings. We had a broken and shattered area, there was a number of open crevices one-half inch wide. That volume continued to run for eight months and then we struck a succession of fissures until at one time we had thirty second feet coming out.

Whenever we struck these fissures the water was there to flow out and continued to flow out of the fissures and the fissures had rock sides to them and the water had velocity. Then we suspended work for a time. Our flow decreased down to seven feet in the month of January, 1914, at 6,700 feet from the portal. From that time on we struck numerous fissures before we came to the diorite, and the fissures as we came to the diorite, and the fissures as we struck them one after another yielded from seven to twelve second feet, it was up and down as we struck fissures and beds and their flush came into the tunnel. We struck a number of fissures in their and those fissures had walls and the water came through the opening between those walls and had velocity and all those fissures crossed the tunnel, most of them at nearly right angles, and they were fissures that projected across the master drainage depressions of Snake Creek.

Just after we passed the diorite, about 10,600 feet the flow from the tunnel was about 17 cubic feet per second and in running in, the flow had increased at times and decreased at times. The low flow shown on my plate being the year 1918, at substantially 14 second feet.

I spoke about a fissure in the granite, a large opening in the rock, through that water flowed. It was running along somewhat parallel with the tunnel as described on the board and put in as an exhibit. It was not one opening in the true sense of the word, it was a series of openings. This fissure appears to have been running
341 almost at right angles to the other fissure crossing the tunnel. The length of the opening exposed was approximately 60 feet and about 100 or 150 feet ahead of that point it had been exposed by the cross-cut marked "W" on the exhibit on the board. It was carrying six or seven second feet of water. From that point out

we were in the diorite, and it was full of joint cracks, it was cracked and seamed with small voids between the very small blocks, water dripped or flowed through them and through this fissure and other openings and through other openings there has been maintained a flow of water, as my measurements show, of not less than 14 second feet.

When we had 17 second feet of water in February, 1918, when we struck this fissure in the diorite, it was 2,000 feet straight ahead to the divide. We were then 2,000 feet inside of the divide of the Snake Creek drainage area.

The tunnel was stopped in 1916. When it was stopped the amount of the flow was 18.25 second feet. Between the 10,600 point and where the tunnel stopped the peaks fluctuated from 20.25 down to 14.75 and since we stopped in 1916 the flow has fallen to substantially 14 cubic feet per second, or four cubic feet per second less than it was when we quit.

All the way through, whenever we struck additional flows of the water the water was there when the tunnel met it and has continued to flow into the tunnel through the Snake Creek drainage area. The water was there when the tunnel went in and has stayed there ever since.

The perimeter of the tunnel would be about two rods. 16.5 cubic feet per second flowing out of the tunnel would be substantially 32 acre feet (every 24 hours). The tunnel being in two miles, the area of the perimeter for the length of two miles would be something like eight acres. So, if we had eight acres and thirty-two acre feet that would be four acre feet per acre of tunnel surface. In order to get that much water into the tunnel the entire surface of the tunnel from the mouth to the two miles depth would have to be yielding four acre feet of water every twenty-four hours. It did not come into the tunnel in that way, it came in in a much smaller area.

If the tunnel was thirty-two feet that eight acre feet would mean a wall of water which moved four feet during the day, supposing it came in all over the tunnel.

Assuming that all of the area of the tunnel was yielding water and the drainage of water in the rocks was five per cent, the
342 water would have to move practically 60 feet in a day, but it does not act that way. That would exhaust all of the water within the area if there was not any coming in. In giving my judgment of the area of the perimeter of the tunnel yielding water flow, I would give the wildest kind of a guess, it would be a very small part of the eight acres, not over ten per cent.

In order for the water to flow into the tunnel in the volume it does, it has got to have considerable velocity where only one-tenth is open space. Where there is only five per cent of the content water, and where only ten per cent of the tunnel is water courses of any kind, it is obvious that the water flowing into the tunnel flows with considerable velocity at the time it enters the tunnel. I would not say as high as many thousand feet a day. Since water has flowed from the tunnel and into the tunnel through these [appertures] it has flowed

from openings which discharge into the tunnel and where these openings extend I do not assume to say. I will say that the openings that are now sending in water and their tributary fissures, openings, joint cracks and everything else extend over the entire surface of the globe. I do not know how far, or where the tributary waters to Snake Creek are, or where those of Lavina Creek are. Snake Creek and Lavina Creek are natural drainage depressions. They cross-cut the rock formation of the earth. Snake Creek tunnel is an artificial drainage depression and in general it cross-cuts the same country.

I agree with Mr. Boutwell when he says that the Park City district is or about the center, of the district of great movement. But he goes a little further than that in his statement. The movement has been great in that section of the country. In some places formations changed their place and locality two miles; put formations underneath on top. Speaking generally, the whole country is fissured and fractured and crushed.

The flow of the tunnel on July 29th, 1911, was 2.50 second feet. The transcript of the evidence on the Mountain Lake case shows that a measurement made by Mr. Ross on July 29th, 1911, shows the total flow of Snake Creek, figured from rectangular weir, to be 29.23 cubic feet per second. Subtracting 2.50 cubic feet per second from 29.23 leaves 26.73 cubic feet per second. Subtracting the tunnel water from the flow of the creek as measured by Mr. McKay on July 16th, 1915, gives us a trifle over 10 second feet per second, whereas subtracting the tunnel flow from the flow on the 29th of July, 1911, leaves 26.73 cubic feet per second in the creek.
343 On July 28th, 1916, 17.32 cubic feet per second in the creek. Taking those together does not have any influence on my judgment, because you have not taken in the comparisons.

Redirect examination:

I mean by saying that Mr. Wedgwood has not taken into comparison—taking July 29th, 1916, will give 21 second feet coming out of the canyon; August 28th, 1916, with less water coming out of the canyon at that time of the year, and also less water coming out of the Mountain Lake tunnel, will give 27 or 28 second feet, and in the year 1917, it will give the same story. October 1, 1917, gives 32.48 after deducting the tunnel water, and May 23rd, 1918, gives 27.89 after deducting the tunnel water. September 2nd, 1917, gives 33.45 after deducting the tunnel water and August 6th, 1917, gives 25.28 after deducting the tunnel water. That is all I mean by saying you have got to take all those figures to get your fair comparison.

Mr. Boutwell says that the area of great movement was along an axis running from Clayton Peak stock south 70 degrees west through the Park City district and there is an uplift along that line.

The Ontario drain tunnel and the Snake Creek tunnel pass through the same formation, the lower [*limes*] lying under the Weber quartzite.

I stated that I absolutely disagreed with Mr. Boutwell in a number of respects and further stated I had actually proven, since he made his examinations, that he was wrong.

It was ten years after Mr. Boutwell made his examination before professional paper No. 77, giving the result of his examination was published. He made his examination in 1902 and 1903. Since then there has been a great development at Park City. I am aware that Mr. Boutwell objected to the publication of that paper, because he said he wanted to bring it up to date; that he realized the great changes in the camp in that time, and he wanted to have a chance to make the necessary changes in his favor.

Referring particularly to that portion of professional paper No. 77 which refers to the wet conditions of the underground works in Park City, I absolutely disagree from the statements which [wwre] called to my attention from this paper by Mr. Wedgwood, because they are controverted by facts which have been developed in the last seventeen years. In the first place his general statement that
344 the Ontario tunnel has lowered the water table 1,500 feet is
absolutely wrong. I have prepared a map from actual conditions existing in Park City at the present time which has been marked Exhibit 187, to show a portion of that condition. To show it all, I would have to bring in a map of the entire district, but it will show a condition in one portion which can be duplicated in numerous portions.

Exhibit 187 is a drawing along the line of Anchor tunnel in the Daly Judge, the Silver King, the Daly, and the Daly West mines. The Anchor tunnel is represented on Exhibit 173 by the upper black horizontal line on the right hand side of the map marked "Judge Tunnel"; the level of the No. 1 Ontario drain tunnel is shown in the dotted red line, it is not shown in a full line as it would have to be slightly projected on the section which we wanted to avoid, it is labeled "level of Ontario No. 1 drain tunnel." The level of No. 2 Ontario drain tunnel, which is the one that Mr. Boutwell mentions, is also indicated by a red line with a raise showing its connection with another dotted red line which is the Daly Judge or Judge 2300. When I say the level No. 2 drain tunnel of the Ontario is the one mentioned by Mr. Boutwell, I mean that is the one he claims dried up the country above it and lowered the level of the ground water.

There is also a little bit east of this section a vertiable honeycomb of underground workings connected with the various tunnels by artificial arteries along the line of the section,—along the Anchor tunnel in a general southwest direction, shown on Exhibit 115 as the yellow line marked "Anchor tunnel." Section 187 is erected along the line of the Anchor Tunnel but continues further to the southwest.

The black line running horizontally to the southwest of the Judge shaft indicated the main working levels of the Judge mine along that particular section; the cross-hatched area indicate- worked out ore bodies. The small vertical line marked "White Pine shaft" indicates the White Pine shaft workings of the Judge mine with the stoping from the levels as shown. The vertical shaft to the northeast of the Judge shaft indicates one of our ventilating shafts running down to the tunnel. It is labeled "Intermediate shaft." It is always wet. The black horizontal line and incline represents the Utah

tunnel workings which are also part of the Judge workings, running in from the surface and to the left of the White Pine shaft. The yellow and blue tinted contact represents the present height
345 of the water table over that entire section. This is determined by an observation near the portal of the Anchor tunnel.

Near the intermediate shaft where the water continually rises into that shaft, at Lady Morgan lake where there is a natural spring running throughout the year I have got "lake" here and "spring" here; that is, this spring feeds the lake. The main Judge shaft with all the workings from it; the White Pine shaft which is almost filled with water; also the lake to the southwest and swamp land. The heavy black line at the top, running from the left to the right, represents the surface of the ground along the section I refer to. The yellow portion immediately under that represents the portion of the soil from which the water has been removed. The blue portion in contact with the yellow portion is intended to represent, at the immediate contact, the ground water level. The blue beneath that is intended to represent wet area.

Starting from the portal of the Anchor tunnel, at the point where that arrow is pointing towards the Anchor tunnel, we encountered a wet area. As we proceeded to the left we again encountered the wet area at the point marked "always wet," and passing on up over the surface you get to the point marked "lake" where you always find water at any time of the year. As you go higher up on the surface you get to the point marked "spring." The Daly West get all their water for the supply of the Daly West mine from that spring throughout the year, there are workings running right under it from the Anchor tunnel.

Then you come next to the Daly Judge shaft and at the point where this shaft first intersects the blue tinted portion and from that point down, during all seasons of the year, you are in very wet areas. As you pass to the left at the point where the White Pine shaft first intersects the blue tinted section, and from that point on down, you are in a wet area during the entire season. My note is, "always contains water," all but the upper level is under water.

Passing again to the left you come to the Utah incline marked "wet." At the point where this working first intersects the blue line, from there on in, it is always a wet area throughout the season. Passing along on the surface we come to a point on the surface marked "lake," the lake is there throughout the year.
346 Passing further on we find marked "swamp land." That is swamp land throughout the year. The network of underground workings near this line of section will include the blue workings put on Exhibit 115, by Mr. McKay, a portion of them only, just those along the line of section.

Notwithstanding the Ontario drain tunnel, the two of them shown on Exhibit 187, and the other workings shown on there, and the network of underground workings to which I have referred, it is a fact, as represented on Exhibit 187, that the actual openings from the surface down show the ground level of water to be as indicated on 187. They actually had men drowned in that area from the rush of water.

Some two years ago we were sending a raise from the Anchor tunnel alongside the cross hatched workings which indicate the stopes on Exhibit 187, and after the raise had gone up a distance of 95 feet the walls broke out from the top and drowned one man and seriously injured two others. That was more than fifteen years after the Ontario drain tunnel had been driven in to drain that country; after the Anchor tunnel was in; after the No. 1 Ontario was in and after that area had been honeycombed with works.

Another place where this condition can be duplicated is in the raise marked with a semi-circle line on Exhibit 173 just to the right of the Daly vein which I will mark "X." The entire country there is cross-cut and cut by numerous workings, yet, one year ago in an entirely unexplained manner without any work being done at that point, the entire top of that raise filled in, ruined the entire raise and delivered a large volume of water, that water is still flowing. The water of the upper levels is just the same as it was before; we can find no indications of where it comes from.

Again in the Mears shaft which is located near the Daly West shaft in Exhibit 115, has several miles of workings running from that shaft; the Daly West mine has also workings under that zone, and about nine years ago a drift by the Daly West mine was sent out into that area and accidentally we passed within 25 feet of those workings having 500 feet of water in them and never drew a drop. In the case of the Little Bell mine at the time that was being drained by the Daly West, it had about 175 feet of water in it; we came up under that water to within 10 feet without drawing a drop, and then sent a drill hole through and drained it. At the time the drill hole was started there were miles of workings under that area.

347 Prior to the year 1910 the workings shown on the area in 173 were nearly the same, except that the raise marked "X" and some of the far workings were missing. There was a concrete bulkhead in place at the point marked "Z." This concrete bulkhead was placed by the Daly West management, and sealed up the No. 1 Ontario drain tunnel at that point. The result of this bulkhead was to fill all the workings of the Daly Judge mine to above their 1,300 foot level. This bulkhead caused the water to be dammed back and fill up or flood the Daly Judge workings, notwithstanding the existence of the Ontario drain tunnels which had existed there for years, and also numerous workings within a very few feet of each other on the other side.

Referring to what Mr. Boutwell says on page 26: "In contrast with the large amount of water encountered in the outlying properties, the practical absence of water in the new workings, such as the Wabash, New York, Naildriver, and American Flag, in ground adjacent to the large mines, and thus within the drained region, is noteworthy." That was a fact at the time Mr. Boutwell made his examination. Since that time all of those mines have been drowned out; none of them are at present operating and the only reason for not operating is that they cannot pay for the pumping necessary to unwater their workings.

In the case of the Wabash which is almost over the Ontario tunnel,

they were driving a tunnel from their 600 level into the upper workings of the Ontario at a distance of about 1,100 feet above the Ontario drain tunnel. While running that tunnel they hit a sudden flow of water and in spite of all they could do the water came in so fast it drowned their horses on that level before they could be hoisted. In other words, the prosecution of this tunnel for the purpose of draining the water out of the Wabash into the Ontario resulted in exactly the opposite condition, namely, it drained the water into the Wabash so as to flood it, and they have never been able to unwater the mine. That was about six or seven years ago.

The New York has its lower levels under water and they cannot carry any work down, the Naildriver is in the same position. A portion of the American Flag lies on one side of the Ontario drain tunnel and a portion on the other and the tunnel follows through this property for several hundred feet. All of the lower workings above the level of the Ontario tunnel of the American Flag have been drowned out for years, and certain workings existing
348 on the other side of the drain tunnel are also drained out. The water level along the entire workings is over 400 feet above the Ontario drain tunnel level.

I account for the fact that at one time after these mines were run they were at least dry enough to be run and be worked and that they subsequently filled with water, because at that time they were only working to shallow depths and those mines are along the top of the mountain side where the water table would normally be lower than anywhere else, but as soon as they got down to any depth they got the water that was there before which raised to some extent and filled the upper tunnels, it did not come right to the surface.

Referring to what Mr. Boutwell says on page 102 of professional paper 77 which is headed, "Level of Groundwater," he states: "Evidently the ground water level in this district was high. From the main divides it descends beneath and accordant with the surface and re-appears at the master drainage depressions. This level, after the escape of enormous quantities of water, has been lowered about the deeper workings to a depth of 1,500 feet and has been modified accordingly in tributary ground." That is not a fact at the present time. My exhibit 187 shows that it is not a fact. He then refers to the Daly Judge (old Anchor), stating: "In sinking in fairly early times close to the divide, where the water level naturally stood high, met baffling flows of water. Eventually a drain tunnel became necessary here and a long tunnel was driven from Empire Canyon to intersect the Daly Judge shaft at a depth of 1,200 feet." The fact is that the underground workings of the Daly Judge are now all very wet; and that condition has existed through all the years I have been there and those workings are above the Ontario drain tunnel.

I was asked whether or not it was my opinion that if a dozen tunnels like the Snake Creek tunnel were driven into the Snake Creek area they would lower the ground water level. In regard to this I have to say—it would, providing the dozen tunnels would take out more water from that area than was deemed fed into it; in the case

of the ground water level after you have enough openings running from the ground to overbalance the inflow into the ground, you will naturally lower the ground water level, but in the case of the Park City district, even with between two and three hundred miles of tunnels, in addition to acres and acres of stopes and miles of [*raisea*] and miles of winzes, the water level has not been
349 materially lowered except in very local areas where there is a perfect honeycomb of workings.

The ground water level, or the existence of water underground does not necessarily depend upon the fall or precipitation over the surface at that particular section. On page 74 of Elements of Geology by Le Conte, 5th edition, 1904, it is said, "As we have already seen (page 10) of the rain which falls on any hydrographical basin, a part runs from the surface, producing universal erosion. A second part sinks into the earth, and after a longer or shorter subter-an*n*ean course, comes up as springs and unites with the surface water to form rivers; while a third portion never comes up at all, but continues by subterranean passages to the sea. A fourth portion escapes by evaporation. In arid regions this is the major part of the total rainfall. This last portion is removed from observation, and our knowledge concerning it is very limited. But there are numerous facts which lead to the conviction that it is often very considerable in amount. In many portions of the seashore, springs, and even large rivers, of fresh water, are known to well up. Thus, in the Mediterranean Sea, 'a body of fresh water fifty feet in diameter rises with such force as to cause a visible convexity of the sea surface.' Similar phenomena have been observed in many other places in the same sea, and also in the Gulf of Mexico near the coast of Florida, among the West India Isles, and near the Sandwich Islands. Besides the last mentioned, there is still another portion of the subterranean water existing permanently in every rart of the earth far beneath the sea level, filling fissures and saturating sediments to great depths, and only brought to the surface by volcanic forces. This, in contradistinction from the constantly circulating meteoric water, may be called volcanic water."

I have another authority by Weed on the Butte district. He is one of the famous geologists of the country. He made the most detailed examination of the Butte district ever made. He was geologist for the United States Government. The geological formation of the Butte district is granite. It is very nearly the same as this portion of the country which has the diorite formation, except that it is a little more acid rock.

In speaking of water delivery I quote from his monograph; "In short all the evidence shows that the waters are surface waters seeping downward. They come, however, from a broad area and not from the surface of the Blue mines alon*g*."

350 I stated in my answer to counsel on cross-examination that these fissures or fractures which are cut by the Snake Creek tunnel extend clear around the earth. I meant that literally. I did not mean that the fissures or fractures which are cut by the Snake Creek tunnel are continuous around the earth, I meant that they are joined on with other openings, capillary, sub-capillary and super-

capillary; which in turn join with other cracks which join with other joints, so that the entire surface of the earth is literally joined by a multitude of small and large cracks reaching entirely over its surface and down in depths to the zone of cementation. In my opinion, the fissures in the Snake Creek tunnel are short fissures or fractures. In answer to counsel on cross-examination, I stated that if the fissures which are intersected by the Snake Creek tunnel extended far enough, they would cut across and through the master drainage basin existing on the other side of the Snake Creek tunnel, but there is no evidence of any of those fissures being so extensive as he supposes in his question. The fact with reference to these fissures is that there is every indication that they are not so extensive; there is every evidence they are not, as we have no major faultings shown in the tunnel. In my opinion the fissures and fractures cut by the tunnels are short fissures and fractures.

Absolutely, it is not necessary to have any large movement of earth to produce slickensides.

Counsel called my attention to the fact that when we were at station 10,600 we had 17 second feet of water, whereas at the present face which is 14,500 feet we have only 14 cubic feet per second. I can explain the reason why there has been a decrease since that time. If we had not gone further the 17 second feet would have decreased rapidly because we were just hitting the water — at that time. We did at one time during the driving past that point have 17 second feet of water, but it is the history of all tunnels when you first hit a fissure or opening that you have more water than after the pressure eases off and it drops to a normal flow.

As to the velocity of the water flowing underground into the tunnel, the velocity previous to reaching the tunnel is undoubtedly very much less than at the time it reaches the tunnel because it is delivered through thousands of openings, capillary and sub-capillary, some of them may be super-capillary and probably are; it is all coming into the main tube which we would attach, consequently the
351 velocity of the upper layers would be very low through those
smaller openings, but when we open it into the tunnel that drains the tube.

At the time of cutting through the formation I did not find any open water courses or channels which was not filled with some kind of material through which water had to percolate or pass. There was no channel, fissure, fracture or opening through which water was delivered into the tunnel which I knew to exist on the surface prior to the time the tunnel cut it.

There is a small seasonal variation of the flow of water in the Snake Creek tunnel which reached its peak during the month of September 1916 and 1917 which are the only two years I have been able to judge that as the tunnel was being driven prior to that. From the point marked by the arrow, substantially at the point 14,500 feet, on Exhibit 144, the flow of water is shown not in accordance with the progress of the tunnel, but in accordance with the lapse of time. And therefore, it is only that portion of the hydrograph which will indicate the seasonal flow of the tunnel. The two peaks I refer to

are the peak in September 1916 and the peak in 1917, indicating that that is the highest flow of water in the tunnel in those years. In the year 1916 it amounted to 9.9 per cent of the total flow and in the year 1917 about 22 per cent of the total flow.

The seasonal variation of the Mountain Lake tunnel comes in the last of July or the first of August. The Mountain Lake tunnel is 1,700 feet higher than the Snake Creek tunnel.

I have prepared a chart for the purpose — comparing the seasonal variation of the flow from Snake Creek tunnel, Mountain Lake tunnel and the natural streams which has been marked "Exhibit 188." This exhibit shows the percentage of variation in the Snake Creek tunnel throughout the entire year while of Lavina Creek and Snake Creek I have limited it to only the low water season. I do this because the surface run-offs would make it still larger and I have taken the low water season when there is no surface run-off to be considered.

In the Lavina Creek and Snake Creek tunnel for the year 1916 and 1917 it is 9.9 per cent. I mean by that, the total variation of amount of water in the entire year going out of the tunnel, that is the variation I pointed out on Exhibit 144 in the year 1916.
352 Lavina Creek has a variation of 141.3 per cent. Snake Creek has one of 277.5 per cent. Snake Creek tunnel for the next year is 22 per cent, that is the variation in September, pointed out on Exhibit 144. Lavina Creek has 206.5 per cent and Snake Creek 406 per cent.

Referring to Exhibit 144 the flow seems to decrease from January 1917 down to the latter part of March 1917. From [*there*] there is a slight rise in the flow and the same thing is occurring during the present year; then it falls in again between June and July creating a sort of a hump in the hydrograph, and from that point gradually rises to the highest point which is reached in September. Undoubtedly that little hump is due to the seepage into the tunnel at the time the snow is melting around the tunnel. This little hump existing between May and June on the Snake Creek hydrograph would correspond with the high flow of the Mountain Lake tunnel. The only conclusion I can find for the late season peak in Snake Creek tunnel is that the source of water causing that peak is a great distance from the tunnel, or if it does come a shorter distance it is through very short openings and travels very slowly. In other words, if the water came directly down from the surface at the deepest point in the tunnel, it would only be traveling at the rate of about three feet an hour.

Exhibits 187 and 188 received in evidence.

Mr. MacMillan: I desire, as part of the direct examination of Mr. Friendly to offer in evidence the tabulation showing the cost of the tunnel by years, the total cost of the tunnel, and the cost of the tunnel up to March 11, 1915, the last figure being $346,044.40, and the years being separated showing the cost from year to year.

Mr. Wedgwood: We object to it as incompetent. It is no more competent than the cost of putting Midway to irrigation.

The Court: I doubt if it has any materiality in the case.

Mr. MacMillan: I think your Honor will find when we come to argue the case that it does have.

The Court: It may be received upon your theory.

Mr. Wedgwood: Save an exception.

Mr. MacMillan: I now substitute for Exhibits 160, 161, and 133 photographic copies of those exhibits, they being notes of
353 measurements made and computations by Mr. Stoner; and I offer in evidence as Exhibit 190 the coefficients from the pamphlet which was used during the examination of Mr. Stoner, being the coefficient or the table of coefficients to be applied to velocities of floats to obtain the mean velocity in canals. And as Exhibit 191 that portion of the same pamphlet which was referred to respecting the "N" or roughness in Gutter's formula.

The Court: They may be received.

Mr. MacMillan: I now offer and substitute for Exhibit 158 a corrected tabulation to be marked Exhibit 158, and for 159 a corrected tabulation to be marked, 159.

The Court: They may be so marked.

Mr. MacMillan: I offer in evidence the measurements of Springer Spring, and the measurements of Mahogony Spring segregated from the tabulation of measurements made by the engineers for the plaintiff and marked Exhibit 140.

The Court: It may be received.

Mr. MacMillan: I have here a tabulation of the figures which were made on the board by counsel for the plaintiff and Mr. Stoner during his cross-examination relative to the experiments which were made by witnesses from both sides and indicating the particular points or stations to which these figures relate. I offer that in evidence as Exhibit 193.

The Court: It may be received.

The Witness: I know that experiments have been made by eminent men for the purpose of determining how fast water will flow in sand and gravel substances of different sizes, and I have the results of those experiments. They are found in Myers' Elements of Hydrography. Over a one per cent grade the following results are shown of the flow of water through sand and gravel, the diameter of the sand grains being given in decimals of an inch:

0.0039 gives a velocity of feet per day of 82;
0.0078 " " " " " " " " 328;
0.0117 " " " " " " " " 738;
0.0156 " " " " " " " " 1312;
0.0195 " " " " " " " " 2050;
0.039 " " " " " " " " 8200;
0.117 " " " " " " " " 73800.

354 The velocity which I gave the other day figured at 72 feet per day; under this slowest velocity, is 82 feet per day; the grade given in the book is one per cent, while the grade upon which I figured 72 feet per day is vertical, which, of course, would have the tendency to make the velocity faster to a marked extent.

We found nothing in the tunnel that compared with the diameter of said grains which would be equivalent to Portland cement; as the

diameter of the said grain increased, the velocity increased, as shown by this table. The figure I arrived at the other day would be the velocity from Clayton Peak down to the tunnel, a distance of 3,000 feet, which would be the longest distance vertically; if it came laterally through any distance you would have to multiply it accordingly.

Attention was called by counsel on cross-examination to my chart giving the precipitation at Heber. I have explained that I accepted the data which had been gathered at the Heber station. My attention was then called to the fact that there was a precipitation station in Snake Creek canyon, and when I was asked this question: "And still you were satisfied to use the Heber City precipitation instead of the Snake Creek canyon precipitation?" I have reason for being so satisfied and I can best show it upon the map.

The comparisons on the map show the same ratio for the Snake Creek station as they do for the Heber station. I mean on Exhibit 145. The comparisons referred to are for the years 1914, 1915, 1916 and 1917, the only years for which we have records of the Snake Creek station. I mean that the comparisons of the Extensions which I placed on Exhibit 145 from the Snake Creek precipitation records at the request of counsel for the defendant on cross-examination and which are shown on Exhibit 145 by the black vertical lines faced with red, would be proportional to the precipitation at Heber City.

I stated to counsel on cross-examination that I was satisfied that temperatures at Park City would not vary for 1,000 additional feet in altitude surrounding Park City, and my reasons for stating that are, that Park City is located at the point of two canyons where the measurements referred to were taken. It is just as cold *as* this point as it is at the Judge mine, 1,000 feet above, or in any of the areas 1,000 feet above. It is always much colder at this point than it is at any other point at the same elevation: the juncture of the
355 canyon causes it to be colder than it would be at other places.

It appears in the evidence that as the tunnel progressed water would be encountered from place to place flowing in from the sides, from the back, sometimes from the floor of the tunnel, and after the work had progressed some distance in places the flow from the back and sometimes from the sides of the tunnel would cease. My explanation of this is that in the first place the water would ease off as is always the case in tunnel driving, and another reason is that at the orifice right at the tunnel would be enlarged and the water feeding in, when it came to that enlarged orifice, would run down the sides in the openings and come out at the bottom, on the floor of the tunnel.

This tunnel was located at what after investigation was determined and believed to be the most available place for the purpose for which it was designed, and in my opinion as an engineer, the course and depth of the tunnel were the proper course and depth for the development of drainage of the properties which it was intended to develop and drain.

Mr. MacMillan: Are you willing to stipulate, General, that no objection was ever made by anyone connected with the Midway Irrigation Company to the running of this tunnel?

General Wedgwood: Yes, of course, with the declaration that as a matter of law, in our judgment, that means the defendants, we had no right to object. No use making any remarks because all this will all come out in the argument.

I testified that a number of statements made by Mr. Boutwell in professional paper No. 77 are incorrect as subsequent developments have proven. I had no intention of in any way criticizing Mr. Boutwell or his work.

Recross-examination:

I have said exhibits 155, 154 and 153 were made to showing conditions on July 1st. I mean to say that White Pine Creek was in the condition represented here on July 1st as to any one of these years. It might by a very small amount exceed*ed* the width of the line. White Pine creek on the 1st of July generally flows several second feet. On the 1st of May it had three second feet in it. I do not remember what it was in July, but the flow depends upon the question of when the flush water comes, when the snows are melting and surface run-off is greatest.

356 Speaking about Snake Creek tunnel and the flow into it from the openings which were cut, what flows through a given opening; by that I mean all the factors in regard to that opening are constant depends upon the static head or the height of the water.

Where I said, adopting Mr. Tanner's phrase the flow becomes equalized through a given opening, that means that the static head has been reduced, and wherever we see upon the hydrograph the peaks and the recession of the flow, it indicates as said by Mr. Tanner, *and* equalizing of the flow. It also indicates the static head has been reduced; the pressure at the orifice has been reduced.

It is not my idea that water would not run through those fissures before we drove the tunnel. If water would and did run through them it would flow through in a similar way as water runs through a refilled bed of a stream that carries water, but it would not run as rapidly. Whether it would run as rapidly would depend upon the kind of material there was in both places; the means of transportation of water and the fact of its transportation would be the same. All of these fissures I speak of that discharged water were practically filled. Notwithstanding these fissures cut by the tunnel were all practically filled and therefore afforded a greater resistance or impediment to the free flow of water than they were after they were washed out to some extent, nevertheless when we struck water at substantially 3,150 feet, there flowed through the filled fissure there 550 second feet immediately, and within a few days the flow dropped to 2.50 second feet and rem*ia*ned at 2.50 substantially for a period of approximately two months and a half. So then, if that fissure was filled and if it washed out and therefore you had a freer passage for the water there, nevertheless, less water flowed at the orifice.

I do not say that it did not reduce the ground water level in some area that was tributary to that fissure. It did reduced it right around the tunnel; and localized area. It is not my idea that that was

within ten feet of the tunnel. It may be it was within one hundred feet of the tunnel and it may be it was within one thousand feet.

Along in September we struck another fissure and immediately we struck it the water raised to approximately five second feet and that flow continued until January, 1912.

Then at various stages we struck other fissures until above October 1st, 1912, we struck a large flow, notwithstanding the fact that
357 that fissure was filled with material, there was a large flow of water amounting to 17 second feet and within a year that had drained down so that there was seven second feet flowing.

Using the ground water level, strictly speaking I do not know whether we lowered its level anywhere. It is perfectly consistent to me that we could strike an opening in the rock which with the other openings that we had crossed before, would yield a total supply of seventeen second feet, and then within a year that flow would go down to seven second feet and not lower the level of the ground water in any area around there. In all probability the ground water level would stay the same everywhere except possibly where you localize points. As to its only taking a very localized point to supply a flow of 17 cubic feet of water per second, certainly not. If a flow of 17 cubic feet per second from given orifices, subsided down to seven cubic feet per second from the same orifice, it is my judgment that it has not lowered the level of the supply at all. That process went on as has been described until we struck the diorite. The diorite fissure, so-called, was not filled with sand in the [stric*k*] sense of the word "sand". It had some fine material and some coarse material. It is my idea that it was completely filled; that there was no appreciable voids like an inch or half an inch. We took out 150 or 200 carloads of wash material after we struck the fissure in the diorite. It was decomposed wall rock, some were large boulders, some weighing 15 tons, some of them one-third as big as this room.

We had to blast them to take them out of a tunnel 10 feet wide and seven feet high. That is not what I call the filling of the fissure, some of the wall rock that came with it. There was not much material that would go through a ten mesh that we took out of there. I do not know how to estimate it, it was all mixed up; we never separated it, there was some. The truth of it that what we took out of there was the natural irregular shaped pieces of diorite that fell into the tunnel when we drove the hole through, but it was not all vein filling, that is what I am getting at; walls of the fissure gave way. I do not pretend to say the boulders we took out and the other natural blocks of diorite fit together in tight, they were as tight as boulders are and fine material mixed together would pack, as tight as boulders are when those boulders are created by shrinking of the rock.

I would not say that the water came in there with a roar as bad as Niagara, but there -as a roar.

358 I do not know that any measurement was made after we struck the diorite so it could be determined therefrom what water was flowing [f*orm*] the diorite and what was flowing towards

the outer space of the tunnel, from the limestone. I would say that there was perhaps 600 feet of the length of the tunnel where the roof was dripping water. The quantity of water that came in in that 600 feet would be a small proportion of the total that came into the tunnel. Most of the water goes through the fissures into the tunnel.

I have said, without hestitation, that the Midway Irrigation Company was not irrigating 3,500 acres from Snake Creek.

I did not say that the Government precipitation records were wrong; I said they were not complete.

I said without hesitation that Mr. Boutwell was wrong in certain things; in other things he is right.

The connection of 145 with the other exhibits is—that the run-off upon the surface and sub-surface seems to be influenced by the precipitation. I do not know of anything else that is sought to be shown by Exhibit 145. All the proportion shown there is that 1914 was greater than 1915; 1916 was greater than 1915; 1917 greater than 1916. As a fact, 1914 was about 30 per cent greater at Snake Creek than at Heber. In round numbers, in 1915 precipitation at Snake Creek was 45 per cent greater than at Heber. In 1916 and 1917 it was about 50 per cent greater than at Heber. Of course there is a relative similarity as to the amount of precipitation at the two places, that is all.

You understand me to say that the little rise on hydrograph 114 shown in 1917 near the line to the left of the figures "1917" had in my judgment some relation or connection with surface seepage. I use the word "seepage" in a broad sense as water flowing from the surface of the ground into the rocks underneath. It is my idea that the waters flowing down from the surface just flow at that particular time of the year; that was the heavy flow at that time of the year due to the melting snows.

In my judgment the melting snows contributed directly to the flow of the tunnel and out of the tunnel. It is not my opinion that the flow from the surface during the melting snows, lasts for a few minutes during the year, the flow from the surface lasts all the year over the locality and the flow from the surface somewhere supplies almost all the water for the tunnel.

359 The measurements of the high water in the Mountain Lake tunnel in 1914 were made prior to the first of August. I cannot give it more in detail. The highest flow was about the first of August; the water was already going down at that time. The highest measurement of the Mountain Lake tunnel in 1915 was on the 18th day of July; in 1916 on the 1st of August; in 1917 the first week in August. In the year 1912 the highest tide in Snake Creek would be the end of the first week in July; in Lavina Creek the 18th of June; in 1913 in Snake Creek the latter part of May; of Lavina Creek for the same year, the same date. In 1914 the highest point of Snake Creek was the first week in May; of Lavina Creek the latter portion of May; in 1915 of Snake Creek, the middle of May; of Lavina Creek, the 1st of June; in 1916 of Snake Creek, the last of July; of Lavina Creek, the last of May; in 1917

of Snake Creek the last of June and of Lavina Creek the middle of June.

Exhibits 173 and 170 are substantially the same. There is a little difference on the section I think. There are two lakes shown on Exhibit 173, both of them are on top of the diorite. One of them is in wash but I am not sure about the other. My impression is that it is not but I do not know. On 170, Bononza Flat is glacial drift or till most of it and that swamp is situated on this made ground on top of the formation. I am not sure that the lake shown on 170 is in the same formation because there has been heavy glaciation at that point; I do not know whether it is down to bedrock or not.

Exhibit 187 is off the line somewhat from sections 173 and 170. There is swampy land near the lake on Exhibit 187; that is not the same swampy land shown on 170. The lake shown there is a different lake. The left hand side of 187 purports to be Bononza Flat. The swamp and lake represented are the same as are represented on Exhibit 115. Practically all of that country where those lakes and swampy ground are is glacial drift and till or glacial scouring in some respects direct to bed rock at some points; there is a great deal of till there however, that is shown on the exhibits in Mr. Boutwell's work. So far as the rock formation is concerned that presents different conditions altogether from the balance of the country.

I don't know as I said that the New York; the American Flag; the Wabash and the Naildriver were drained as stated by Mr. Boutwell at first; the country around was drained. I said they had no water at first. I did not know anything about the drainage end.

My position is that the ground water, with the exception of
360 the areas I have spoken of, has been in no way effected by
the tunnels in the Park City district discharging substantially 33 cubic feet per second of water at the present time. The ground water does not vary, never has varied by reason of these tunnels, if they had any effect it would have to be very small as the ground water level of the sections there is very near the surface at the present time, and yet, I must concede the same thing I did in regard to Snake Creek tunnel, that almost all of the water that flows out of these tunnels is fed by water that goes into the ground.

It is the water that goes into the ground that feeds tunnels and streams as a rule, it does in this district any way. I am quite positive that the tunnels are not dependent upon surface precipitation around them for their supply of water, not entirely dependent. They may be to some measure of course.

I disagree with Mr. Walter C. Mendenhall the author of Water Supply Paper 219, Ground Water and Irrigation Enterprises in the Foothill Belt, Southern California where he says: "The statement has frequently been made that the underground waters are just as dependent as the surface run-off on precipitation within the local contributing drainage basins, but the tenacity of the oft-asserted belief that these subterranean reservoirs have some other source than local rainfall makes it desirable to repeat this statement with emphasis," unless he is talking about purely local conditions, I dis-

agree with him where he says: "Each of the important subterranean basins in southern California is supplied exclusively by the water which falls upon its surface or flows into it through some tributary stream. Any other hypothesis, as for example, that waters from the distant Sierra or Colorado River or Pacific Ocean may, by underground channels or by seepage, reach the San Gabriel Valley or the Pomona neighborhood, is erroneous, and conclusions based on it are wrong and lead to a false policy in the utilization of the ground waters." He is talking about a local condition at that point and he may be right there.

The first part of the statement that I read is general; I read it again: "The statement has frequently been made that the underground waters are just as dependent as the surface cut-off on precipitation within the local contributing drainage basins." That is general is it not?

A. Yes.

Q. Going on: "but the tenacity of the oft-asserted belief that these subterranean reservoirs have some other source than
361 local rainfall makes it desirable to repeat this statement with emphasis." That is general isn't it?

A. Yes, that is general.

Q. With that you positively disagree?

A. I positively disagree with the writer but I agree with numerous other authorities on the subject.

Q. Can't you answer this question?

Mr. MacMillan: He did answer it.
Mr. Wedgwood: As usual and made his argument.
Mr. MacMillan: The trouble is he answered it too well.
Mr. Wedgwood: If you care for that in your record, of course——
Mr. MacMillan: Yes, we want it.

Q. (Defendant's counsel reading) "The permanence of the underground reservoirs as sources of water supply is dependent on all the conditions which have been outlined as affecting run-off, because as just stated, it is the surface runoff from the mountain areas which must be [refied] upon to re-charge these resecrvoirs; and, in addition, whatever makes this surface run-off erratic—extremely high in winter and extremely low in summer not only makes it less effective in the recharge of the underground basins, but increases the summer drafts on them." That is a general statement?

A. Yes.

Q. Do you agree or disagree?

A. I agree. As a general rule waters which come out are surface waters which some come out from under ground.

Q. That is as far as you go?

A. Yes.

The Witness: The quantity of water which goes to what we term "the deep" is not very small, according to some authorities it is very large, but it is something that is impossible to accurately determine. The fact is that down below the waters are connected with streams, springs and underground sources of run-off. On exhibit

187 below the Ontario drain tunnel I have shown one, we know it is there in that case.

I know that writers on geology and physiography say that down to a certain depth the rocks, whatever there may be there, is to the extent of the voids filled with water, and that the ground waters rest upon those deep sub-surface waters, if they did not they would flow down there; so that the waters of the deep help to hold up the waters nearer the surface. I do not know that the quantity
362 required to supply the loss of the deeper waters is said by all writers to be small. I disagree with what is said in a paper published by the United States Geological Survey, 1903, "The Relation of Rainfall to run-off, page 19: "Stream-flow includes the water which passes directly over the surface to the stream, and also that which is [temperarily] absorbed by the earth and slowly discharged into the streams. A portion, usually extremely small, passes downward into the earth and appears neither as exaporation nor stream-flow." I prefer to take the view of some of the more eminent geologists.

Some rocks and sub-surface material contain water in large quantities and some do not to any extent. Some rocks give up their water to springs and seeps which supply the flow of streams after the surface precipitation has run off very freely and some do not yield it at all. As a rule, limestones yield their water freely if they are not subjected to other conditions. The Park City shale contains large quantities of water and as a rule gives it up freely.

By 187 I have illustrated a typical ground water situation known to exist. My plat shows ground water following the surface and lying beneath the surface on a contour similar to the surface that all writers speak of as the usual relation of ground water to the surface. The space between the surface and the level of the ground water is represented by the yellowish brown; ground water is represented by the blue. Leaving out the other lines I have drawn, to a casual observer, without my explanation, it would appear that ground water permeated generally and in the same proportion all the country shown upon the map. It does not do that, so the map does not convey the right impression as to that.

If you understood me to say that the ground water is not subject to the usual law of draining off when you bore a hole in the ground with a grade, you misunderstood me.

Q. I think the evidence will convey to a man whose mind is as simple as mine, your evidence—that the only possible way of getting any water out of the lands in the Park City district was from water that would be in holes after you dug out the rock, that from some unexplainable and undisclosed sources those drifts, entries and workings got full of water and kept the tunnels running, and the water in the ground around was in nowise affected.

A. Oh, No; I said it was right around the tunnels.

Q. Except three little localities?

A. Yes.

363 The Witness: It does affect the ground waters locally around these workings, around the points of leakage, all the way from five feet up to maybe 100 feet in the Judge workings.

Referring to Exhibit 173 I spoke of the Ontario putting a cement bulkhead in their workings. That had the effect of preventing water from the Daly Judge flowing [througnh] that tunnel, and as a consequence the waters raised in the workings of the Daly Judge in elevation 300 feet, in height. It is not my idea that no water went into the rocks surrounding those openings in that 300 feet. In all probability some of it did. It went in there to the extent there were openings and to the extent of the capacity of the rocks to take it and stayed there while that dam or bulkhead was in our until we made the way around it. It did not create a different ground water level in a strict sense. Water was raised 300 feet in [h-ight] in the openings of the Daly Judge by reason of the bulkhead in the tunnel, but in my judgment it did not [riase] the water in the adjoining territory to the workings to the same height. In my judgment the water in the ground adjacent to the workings was not raised 300 feet or at all.

Redirect examination:

Water is not flowing in the fissures and fractures leading into the Snake Creek tunnel in the sense that you find water flowing in an open conduit, ditch or stream [becasuse] it is travelling through small openings and through bedding planes, capillary openings and it is travelling over very slowly; it is percolating down through formations.

Mr. Le Conte and Mr. Weed state to the contrary of the language of Mr. Mendenhall in his Water Supply Paper No. 219 on page 23. The language of Le Conte was read into the record a few days ago and is the language to which I refer.

At the time the Daly Judge workings were flooded by reason of the bulkhead being in, and backing up the water, the workings of adjoining mines of similar horizons did not show any effect of the daming up of the water, consequently there could not have been a large amount pass out through the ground unless it went into district far away, which we have no evidence of.

Water Supply Paper 232 By E. E. Ellis, Underground Water Resources of Connecticut by Herbert E. Gregory, with a Study of the Occurrence of Water in Crystalline Rocks by E. E. Ellis in part explains some of the answers I have given with reference to the underground workings on the Park City side and also as to the
364 Snake Creek tunnels to draining immediately around the tunnel. On page 105 the language is: "It is only in artificial openings, such as wells, that the water drops from the rock itself. This absence of water on the face of a natural rock outcrop does not indicate that the rock is not saturated at a short distance back of the face, for the water within the rock would naturally seek a lower level of escape through some bedding plane or fracture nearer the base of the hill. In several localities springs issue from crevices immediately above which the rock is practically dry. In such localities the water table is repressed at the point of leakage."

LEONARD WILSON, a witness produced by the plaintiff on rebuttal, testified in substance as follows:

I am a Consulting Engineer, on hydraulic, electrical and mechanical problems.

I know where Midway and the Snake Creek Drainage area is. I am familiar with the Knight Power Plant in Snake Creek canyon and the efficiency of its machinery. I have known the Snake Creek drainage area particularly since the early part of 1909; from the time the power plant started until some time in 1912 I was constantly supervising its operation and am familiar with the character of its machinery and its efficiency.

I have examined the cards of the Knight Power Company which were identified by Mr. Orrocks and introduced in evidence.

In operating the two units of the plant, the pipe must be kept completely full of water. I know the quantity of water necessary to keep the two units operating continuously. That I know from actual observation. It is part of the business in operating a plant to make tests from time to time, and tests of this plant have been made for that purpose from time to time. I conducted one of these tests by measuring the output by electrical instruments and measuring the discharged water in the tail race of the plant. When all of the water which is available is being used at the plant, one can determine from the amount of electricity actually produced the quantity of water used to produce that electricity.

365 P. H. HUNT, a witness produced by the plaintiff in rebuttal at the former trial and whose evidence was read into the record of this trial, testified in substance as follows:

I am a mining engineer. I have a curve which was made to illustrate the flow of the measurements by Captain Springer. The curve shown on Exhibit 33 is correct according to the measurements of gauge heights given by Captain Springer in his testimony and as shown on Exhibit 32. The amount of the flow of Springer Springs, 2.60 second feet as shown on Exhibit 32, has been deducted and the result is shown by the curve.

Exhibit No. 33 received in evidence.

I was in the Snake Creek tunnel during the latter part of August, 1914. The tunnel was in between 8,000 and 9,000 feet from the portal. At that time I made observations of the geological conditions. We were in there on several occassions. I assisted Mr. McKay in making observations with reference to the surface in the vicinity of the tunnel which — shown on the map marked "Exhibit 21."

I observed water coming into the tunnel. In numerous cases the water was entering through the bedding planes alone. I saw water flowing in from the bedding planes where there had been a displacement. I concluded that water would flow northerly if it had not been intercepted by this tunnel, because the dip and strike of the

bedding varied from due north to 20 or 30 degrees on either side, mostly northwesterly, or in about the general direction of the tunnel, and the dip did not vary to any great extent over the greater part of it, and then you could see in the bedding where the dip would vary from vertical to almost horizontal and this was traversed mainly by small joint cracks connecting one bed with another, and these joint cracks, due to the small inclination of the dip, would only vary a short distance from the vertical, maybe thirty degrees, so that water flowing out passing through the bedding would go northerly, the joint cracks being small and perhaps connecting only one bed with another would take the water down for a foot or so, the [wi-th] of one bed, and then flow off on another.

There is no geological formation passed through by the tunnel indicating that any of that water would necessarily flow into Snake Creek, there is every evidence to show that the water could not return to Snake Creek drainage.

366 There is no necessary relationship between the subterranean flow of water and the surface flow in the same vicinity. The subterranean flow is governed entirely by the openings in the rocks, and the openings in the rocks have no necessary relation to the slope of the surface.

As to how the slope from Clayton Peak down to Snake Creek or Lavina Creek is produced. This mountain range is a part of the anticlinal fold that forms the Wasatch range, these beds were folded so that the axes of the strata as they outcrop in the Snake Creek drainage area are dipping away from the surface of the ground, the edges exposed there are called Basset edges.

With such a series of beds as there are here, connected with joint cracks and also fissures, is a very excellent opportunity for the percolation of water into the subterranean depths. There is nothing in the geological formation in that part of the country that in my judgment would prevent that water from flowing northerly into another water shed. The fact that so many tunnels have been driven in this country that do not show any water would lead one to the conclusion that the waters would rapidly drain off, and from the formation of these beds and the joint cracks and fissures, the only possible [*excape*] they would have would be northerly or northwesterly into the Weber drainage.

In going through the tunnel I found places where water came into the tunnel through openings cut through the stratification. I did not notice any place where the channel had been made by the water itself through any stratification, in fact I think from the debris that was in the bottom of these open cavities that the water was not running with any velocity at all, probably moving very slowly. The terms given to moving waters of that character in geology is percolating waters. The debris in these openings and cavities was very small grained sand. In case the water had been running, or running with any velocity at all, you would undoubtedly find that the material would have been unsorted; it would have been in coarser and finer pieces the same as you will find in the bottom of any running stream on the surface. It was small grains of sand.

No part of the tunnel touches the sub-flow of any stream, or the reggolyth or any depression.

367 Cross-examination:

I am thirty-one years old.

I am employed at the Daly Judge and have been for seven or eight months. I came there from Ely, Nevada. There I was timbering in the Verteran mine, I was timbering there about four months. Before I was there I was in Custer County at the Mammoth mine, there I was running a drilling machine, I was there about two months. Before I went there I was in Mexico. The last position I had there was in charge of the porphyry property of the A. S. & R. I went down from manager of a mine to running a drilling machine, then I graduated from a machine man to a timber man. Before I was manager of this mine I was Assistant Superintendent of the Characas property for the same company, for [agout] a year and a half. Before that I was foreman for the Mezatilla Copper Company for four or five months. Before that I was Chief Engine-r of the of the Santiago, a very large mine. I was about a year in that position. Before that I was a cyanide Chemist for the Zentanas Mining Exploration Company, I was their chemist for about six months. I was doing miners work there, we run our own machines and put in our own timbers. Before that I was four or five months at the Bunker Hill & Sullivan in Idaho, doing the same thing, mining and timbering. Before that I was at Treadwell, Alaska. There I was running a machine underground for a number of months and later went into one of their stamp mills as a feeder. I was in the mill about two months. Before that I was working for a firm [-or] six months. Before that I left college in the spring of 1907. The longest I have held any one position is a year and half. I was sent into the Snake Creek tunnel under the orders of Mr. Friendly, Superintendent of the Daly Judge. I have testified in a case of this character before, in San Bernardino County, California, at that time I was employed by the hydraulic engineer there to calculate data that had been taken in a very similar case and platting notes. I testified as to that.

I say I am familiar with the flow of underground waters. I gained that knowledge at college.

None of the books I have mentioned go to the point of laying down the law of the flow of underground waters. The laws are not hard and fast by any means. The general laws covering the flowing underground water are very well understood. There are certain physical laws which cover the flow of underground
368 waters and the theories that are taken from those are corroborated by the investigations in mines and other places.

I have never testified before in a case in regard to the flow of underground waters. I never testified in a case as a geologist. This is my first experience in this class of testimony.

I probably spent about 20 to 24 hours in the Snake Creek tunnel, and probably a week or ten days on the surface, that was in the latter part of August, 1914. I assisted Mr. McKay in his measure-

ments. On the surface I was rodman; I carried the rod and one end of the tape from place to place. When we entered the tunnel I would hold the tape in measuring the distance and taking some of the dips and strikes. I generally assisted as anyone would and observed the geological formations as we went through.

Mr. Friendly sent me in there to prepare myself as an expert to testify to this case. My instructions were to assist Mr. McKay and prepare myself as an expert regarding the geology of the district. While carrying the rod I made no notes. I took notes when we came to taking the dips and strikes. I haven't those notes here.

I believe that all of the water under the surface of the ground beneath the reggolyth within the Snake Creek drainage area flows to the north. I am only speaking of what I have seen of the entire Snake Creek drainage area, only perhaps a half mile or so on each [side] of the tunnel. I know nothing of the area outside of what I have actually seen.

I do not know how large the Snake Creek drainage area is. Assuming that I have a knowledge of eight or ten miles and no more, I said, in my direct examination, that in my judgment the sub-surface waters within the Snake Creek drainage area flowed out to the north. My testimony is not to a great extent based upon opinions which I have formed from looking at geological maps of the Government; that is an inference I had. I said my testimony was only regarding what I had seen. I did not qualify my direct examination when I stated that in my judgment the sub-surface waters within the Snake Creek drainage area flowed out to the north into the Weber drainage area, because I thought there was a rule,—one would naturally suppose when you are testifying you only testify to what you have seen. As to whether I thought it made any difference as to whether or not I assumed the whole drainage area to come within that testimony I thought it would be brought out regarding what I had seen. It would be a very natural question to ask, I gave my testimony with that idea in mind.

369 When I was in the Snake Creek drainage area there was no water from melting snow running down on the surface. As to how the water got into Snake Creek and Lavina Creek if it flowed off to the north the greater part of the water that was coming in Snake Creek came in from the springs that were tapped. I saw hundreds of them. I did not see them near the Mountain Lake tunnel. As to how the waters got into the springs at the head of the Mountain Lake Tunnel and Caribou, if the waters up there, to a demonstration as I have stated must have had a flow north into the Weber drainage area, the water that probably, that is a greater part of the water of Lavina Springs I should imagine would be the slow circulation of the water through this reggolyth rather than water that had once entered the bed of the lime formation in this country.

As to whether I mean to be understood as saying that all the flow of Lavina Creek and Snake Creek, and the other surface streams that collect and form Snake Creek proper, come from the waters that were held in the soil in the reggolyth above the bed rock probably not altogether.

I did not testify that all of the waters that were flowing and entered these lime formations went into the Weber drainage, but I said that I should be quite certain that a great part of it would.

I know that Snake Creek is a stream that runs all the year round after the melting snows are all gone and before the snows come again. As to whether I want to be understood as saying that the water which supplies the flow of these streams after the snow is gone is water that simply runs and seeps through the reggolyth into the stream, or runs into the stream or the surface of bed rock, probably the greater part of it comes from the water percolating through this reggolyth and probably a part of it comes from water that has entered the limestone formation, but due to the deep cuts in these canyons and the bedding planes, percolated in these and entered into the deep canyons, I do not think a large part of it comes out that way. I am not in a position to say what portion of the underground water comes from the overlying soil on the rock. The amount of precipitation that percolates through the reggolyth and the amount which enters the rock formation is varying. I do not
think the greater part of the flowing waters of Snake Creek,
370 during the season when there is no precipitation upon the
surface, finds its way into that creek through the rocks or
fissures or fractures in the rock that are cut by the creek. I think the lessor portion comes through the rocks. Probably the reggolyth would be four or five feet thick all over that area. The reggolyth will only hold so much water. When it won't absorb any more free water the water would flow upon bed rock. After the snows were all gone the water there would be — to continue to flow into the creek, to maintain its low flow, assuming I am correct in saying that the greater part comes from the reggolyth, would be the water saturating the soil above the bed rock.

Sand holds the least free water. Such character of soil as there is on these [mo-ntain] sides is mostly disintegrated rock, in the nature of sand. The best you could say of it is that it is a sandy loam. I do not know what per cent of free water sandy loam would hold. I have not taken the trouble to figure out how many acre feet of water would flow down Snake Creek during the time when there was no surface run-off, that would be an easy calculation for an expert to make. I have not figured out the amount of water the soil over this drainage area would hold according to any basis at all, that would be a very easy matter to do. I have not figured as to whether it is within the bounds of possibility for the soil to contain water enough, or any substantial quantity of water, compared with the flow of Snake Creek in that territory, that would be a very easy calculation to make. I have made no calculations whatever before appearing in this case as an expert to determine the facts in relation to the capability, the flow and source of supply through the reggolyth to Snake Creek, in all of its area, or any part of its area. I do not know whether or not the head waters of Lavina Creek come out of the solid rock and I know nothing about whether or not there are lower accretions to Lavina Creek.

Regarding the springs that I speak about and whether I dug

down to see whether they came out of a fissure in the rock, or were seeping through the reggolyth, or flowed upon the surface of the bed rock I cleared away some reggolyth and I could see that the water flowed; that the water was flowing down on the surface of the bed rock, between that and the boundary or surface of the alluvium. I cleared it away near a small spring at what we called Hoyt's canyon. I dug about a foot and a half deep to bed rock, maybe two or three feet long. It is perfectly obvious that that might have been a perennial spring that at some distance under the reggolyth comes out through an orifice in the rock, but I
371 could not see that it did. This examination proved that for a space of two feet square water was continuing on bed rock and that is all it proved directly.

The extent of my digging in Caribou Gulch was about the same, a hole about two feet square in the spring, the springs was the center of my digging and I saw bed rock there. I believe I am prepared to say that water was running on top of the bed rock below the reggolyth, I think it was. That is all I wanted to say. Those two places were all the places I dug.

In my examination on the surface I examined three outcrops. Those are the only ones I took note of, and from the examination of the three, all upon the same ridge, regarding my opinion, that is all I have to base my testimony on in regard to the dip and flow of water along the dip. I also saw the dips in the length of the tunnel at that time. There is one other outcrop which I failed to mention. That is the contact between the quartzite and the lime, just north of the Revelator claim.

There are quite a number of perpendicular openings in the tunnel between its portal and its portal and i-s face, hundreds of them and they vary in width from the thickness of a knife blade up to probably three feet. There would be two or three of that width but a great majority are extremely small and I suppose there would not be over 25 or 30 that are more than an inch in width. In that two miles there are 25 or 30 openings from an inch in width to three feet, practically across the tunnel, and there are hundreds of smaller ones. Some water is now coming out of the greater number of them. The [rule*s*] is that in the openings near the perpendicular which cross the tunnel, water flows but there are few that are entirely dry. I acquiesce that four fifths of the [*the*] water came from the perpendicular, or nearly so, openings, that would leave only one fifth that could flow upon the bedding plane.

Throughout the greater part of the length of the tunnel where it is in lime there are no seams between the bedding planes that can be seen by t*th*e eye, but there is an opening there nevertheless and it is very easy to see hundreds of openings that run nearly perpendicular. I [me*na*] to say that this tremendous volume of water flows to the north through openings between bedding planes too fine to be seen by the eye.

It is my judgment that these openings, 25 or 30 alone, varying from an inch to three feet in width, extend to a very short
372 distance horizontally and I know that they took twenty-nine hundred mine cars of waste of one of them, perhaps

in a large opening like that, it might extend to a few hundred yards.

As to whether or not I mean that all the water that flows into this tunnel is collected within a few hundred yards of the tunnel in these openings, one particular opening might go a few hundred yards, but that was fed by other openings in another plane connecting with that bedding plane and it was going in a zig zag, diagonal course, finding its way down.

Whenever a fissure or opening carries water, it is absolutely necessary that, in its ramifications, it gets to the surface.

The only place where I saw any water coming from the bedding planes and joints where the rock was crushed or broken along the line of the bedding planes, it was coming in in drips, whereas along the upright fractures or seams it probably dripped into a stream. There were substantial quantities in gallons per minute or fractions of a cubic foot per second coming out of the perpendicular openings.

LEONARD WILSON, recalled by the plaintiff for further direct examination, testified in substance as follows:

I recall having personally made an efficiency test of the power plant in Snake Creek canyon for the purpose of determining the efficiency of the combined unit and for the purpose of determining what maximum output the unit would develop, at what flow of water it would develop that maximum output for one unit. That test was made in the late summer or fall of 1910, three or four months after the plant was first put in operation; and from that test, I determined the matters I was attempting to demonstrate. In order to make the test, I ran the single generating unit at a steady load for sufficient period to get steady readings and to measure the discharge waters from the unit and the electric power output of the generator, and I was able to and did determine at that time and place every factor necessary for me to know to arrive at my conclusions.

The maximum capacity that I witnessed myself on the generator was 565 to 570 KW. output with the valve of the nozzle fully opened so it was discharging the maximum amount of water that it could discharge, which in that case was about 12½ second feet.

373 The minimum quantity of continuous flow of water necessary to operate both units of the power in Snake Creek Canyon to full capacity is 24 second feet. From that information I can determine from the card which was handed me yesterday the quantity that was being used at the plant at the time Mr. Orrocks made the record on the card which was introduced in evidence. From Exhibit 134 handed me the water being used at the plant at that time was approximately 9.8 second feet on December 31st, 1910 for a load of 440 KW.

From Exhibit 135 I can determine from the curve and from the record made on the face, the quantity of water being used at two o'clock. We can take these cards and by taking the curve on the reserve side and applying the figures which I gave and determine

the quantity of water that was being used to manufacture the electricity in kilowatts, as shown on the curve, or by dividing the quantity of electricity shown in kilowatts by 25, that would give the number of second feet flowing through the nozzle.

From the data which was given me from the evidence introduced by Mr. Van Wagenen concerning the La Fell water wheel on Snake Creek and from that data I determined the quantity of water that could be used on a La Fell water wheel, any factor of horsepower stated by Mr. Van Wagenen. A water wheel developing 16 horse power at a 20 foot head would take 11 second feet with a wheel efficiency of 64 per cent it might take 11.5.

Cross-examination:

11.5 second feet would be all the water you could crowd through such a wheel. If the penstock was leaking all the water would not go through the wheel. If water leaked through the dam it would not come through the wheel, so when I do not assume to say that because 11 second feet was the capacity of the wheel to take and discharge water that is all the water there was in the stream at that time.

I know that the year 1910 was a high year for water.

O*n*. N. Friendly, recalled by plaintiff for further redirect examination, testified in substance as follows:

Since yesterday I have examined Myer's Elements of Hydrology from which the test as to velocity in feet per day of water through sand of different diameters—there is a correction to be made,
374 it is the equation marked "H over E". H over L equals unity. It makes this difference in the testimony I gave yesterday. In the gradient it means that the height was equal to the water channel length, the height of the head was equal to the length of the channel.

Recross-examination:

That is, water is moving from vertical to horizontal under a head equal to the channel. My testimony was wrong the other day to the extent of the difference between 1 per cent and 100 per cent.

Mr. MacMillan: At this time I call upon you to produce the papers which I requested you to produce, records of the Midway Irrigation Company.

Mr. Wedgewood: We all will produce all we can, so far as we can find out, all the records we have were left with you.

Wilford Van Wagenen, recalled by the plaintiff for further cross-examination, testified in substance as follows:

I have made search for more records of the Midway Irrigation Company since you demanded specific papers. I have not found them. There is no place to search except with the Secretary. There

are none of the former secretaries there now, most of them are dead. All of the records are supposed to be delivered to the secretary of the company. The only water ticket books I have been able to find are for 1917, we do not usually pay any attention to them after the season is over. The Company may have passed a resolution which required the watermasters to turn these books back to the corporation at the end of the year. I do not think they followed that resolution.

The watermaster gets his instructions usually from the company in the spring of the year. They are not usually in writing. They may have been in the past, I do not know as to that. The watermaster places in those books the names of the man, the name of the ditch and the number of hours during which he may use the water during any particular day.

So that you can take those books for a year and figure out exactly how many hours of water have been used but we have not got the books except for 1917.

375 Redirect examination:

The water tickets do not give cubic feet per second. They are not all made out in the spring of the year. They are made out by the watermaster according to the water available. The number of hours a man can have depends upon the quantity of water.

I remember the case of Wasatch Irrigation Company vs. Fulton. The Midway Irrigation Company was a party to that suit and were represented by John M. Zane. That suit took in the water users of Wasatch County and covered a considerable period of time in its [tr*ail*]. I do not know whether any of the papers that have been spoken of here were used in that case, I do not know anything about it. I know the case ran three, four or five weeks.

Mr. MacMillan: If any of the papers were used there, you have made no effort to locate them, have you?

Mr. Wedgwood: I haven't gone there to get them at all. They are as open to you as to me if they were used there.

Recross-examination:

I do not mean to say that every stockholder has the same number of hours each year regardless of the quantity of water that was available.

Mr. MacMillan: I offer to read in evidence certain extracts from the minute books of the Midway Irrigation Company which were delivered to me by Mr. Van Wagenen, the president. The first page is dated May 4, 1887. It simply states that a mass-meeting was held for the purpose of organizing the corporation. I don't care to read that, I simply want to get the date. "Midway, April 20, 1888. Meeting of Board of Directors of Midway Irrigation Company as per call of the President."

I offer the following portion: "On Motion of James B. Wilson,

the President was authorized to employ a surveyor to survey the outlet of Gunningham Lake with the view of draining it to increase the flow of water."

Page 23: "Meeting of directors of the Midway Irrigation Company as per call of President, held May 26, 1888. James B. Wilson in behalf of the Committee to visit lakes in Pine Canyon, reported that they think it feasible to use the waters of Brimhall Lake and Evans' Lake and recommended that steps be taken to supply
376 labor to that effect immediately. On motion of E. Alder the report was accepted and recommendations adopted.

James B. Wilson and E. Alder were appointed to apply labor to secure six feet of water in each of the aforesaid lakes."

Page 26: "Meeting of Board of Directors, Midway Irrigation Company held July 17, 1888.

President Epperson stated that the object of the meeting was to hear complaint in relation to unequal distribution of water."

Page 43: "Meeting of stockholders held March 6, 1889. Moved by A. Wooten, seconded by M. M. Ross, that directors be instructed to distribute the water according to accrued rights. Carried unanimously.

"Moved by John Murri, seconded by William Coleman that the directors have power to classify the rights of each stockholder and to enter into a book such classification.

John Clayburn moved to amend said motion by inserting: "Not to go back of seven years", seconded by D. Provost."

Page 44: Meeting of directors held March 19, 1889, was to consider the matter of adjusting the water rights."

"Moved by I. Jacob, seconded by Siney Lewis that a plan presented by J. B. Wilson, ascertaining the length of time that each stockholder had acquired the right to the use of water for the last seven years be adopted. Carried unanimously.

"Siney Lewis moved that J. B. Wilson be authorized to have forms for ascertaining the extent of rights, and also water tickets, printed and to draw on the treasury to pay for the same. Seconded by Theo Robey. Unanimous vote.

Page 45: "Meeting of Board of Directors held March 28, 1889. President stated that the object of the meeting was to take into consideration the getting returns on blanks for reporting the application of water.

"Moved by Siney Lewis seconded by I. Jacob, that the column "primary" and "Secondary" be stricken from the blank forms for reporting the application of water. Carried unanimously.

"Moved by D. Van Wagenen that a person be appointed to distribute the blanks as amended to those who claim water under the distribution of the corporation, and too explain the use of the blanks to each, seconded by Isaac Jacob. Carried unanimously.

377 "Moved by D. Van Wagenen, seconded by Siney Lewis that the returns on the blank certificates be meade to the secretary within ten days from date. Unanimous vote.

"Moved by C. O. Robey, that the secretary be furnished a book suitable for recording claims as reported by certificates, seconded by I. Jacob. Carried unanimously.

"C. I. Bronson was appointed to distribute the certificates to the owners of water rights."

"Meeting of Board of Directors held April 23, 1889.

"Committee on Instructions to Water Masters made a written report (see report on file).

"Moved by D. Van Wagenen, seconded by I. Jacob, that the words "paid up stock" be stricken out, and that the words "Accrued rights" be inserted in lieu thereof.

"Ayes Van Wagenen and Jacob. Noes Robey and Bronson. Smith declined to vote. As it was a tie the President decided to vote in the negative."

"Moved by C. I. Bronson, seconded by C. O. Robey, that the water be turned into the ditches according to the stock paid up at the time of the [*of the*] organization of the corporation including the rights of those who have not joined the corporation. Ayes, Bronson and Robey. Noes, Van Wagenen and Jacob. Smith declining to vote. President decided it in the affirmative."

Page 53: "Meeting of Board of Directors held on May 8, 1889.

"Moved by I. Jacob, seconded by C. O. Robey, that an appropriation of $300. Or so much of said amount as may be needed, [*by*] made to reservoir Brimhall Lake and Island Lake in Pine Canyon, said amount to be expended under a committee to be appointed for that purpose; and that J. B. Wilson be authorized to superintend the construction of said reservoirs, on condition that he warrant his work. Carried unanimously.

"C. O. Robey, I. Jacob and C. I. Bronson, were duly appointed said committee. Moved by C. O. Robey seconded by D. Van Wagenen, that a standing committee of three be appointed to investigate alleged errors in the stock as per the Articles of Incorporation, and that where they find parties entitled to the use of more water, they be empowered to instruct the water masters to distribute water to them. Unanimous vote.

378 "C. O. Robey, D. Van Wagenen and C. I. Bronson were appointed said committee."

Page 58: "Meeting of directors held January 6, 1889. "Moved by Smith, seconded by Lewis, that the Six directors be appointed a committee to investigate the seven years rights and ascertain as nearly as possible who own such rights, and that the water be cut off to that class of rights said committee to report as early as possible. Unanimous."

Page 59: "Meeting of Board of Directors held on June 11, 1889.

"On motion of Smith a committee of four was elected to hire and equip four men to start June 12, for the purpose of assisting in securing the water on the head of Provo River, and the following commit-

tee was elected: Wilson, Smith, Robey and Bronson. Carried unanimously."

Page 60: "Meeting of Board of Directors held June 17, 1889.

"President stated that the object of the meeting was to hear report of committee on ascertaining seven years rights. Bronson stated that they had seen all interested parties and that the cut-down would amount to very little, as some were claiming more than they had before. The Board examined the [writter] report and made some corrections."

"Meeting of July 1, 1889, of Board of Directors. President Wilson presiding. Prayer by B. M. Smith.

"President stated that the meeting was called to consider the distribution of the water as there were some complaints on the seven years cut.

"President presented a bill of damage of George Bonner, Sr., dated June 22, for a lack of water."

"Moved by B. M. Smith, seconded by Robey that a committee of two be appointed to investigate the claims as to the cause. Carried unanimously.

Page 75: Meeting of Board of Directors held January 28, 1890.

"Moved by B. M. Smith, seconded by Robey, that a committee of three be appointed to formulate a plan for distribution of the water, and to ascertain on what terms they can employ suitable water masters and also to define their duties."

379 "Meeting of Board of Directors held March 22, 1890.

"Committee on instructions to watermasters gave a report which was read, and on motion of D. Van Wagenen was referred back to the committee for further consideration.

"Committee on watermasters retired to amend their report, after which they presented the instructions to the watermasters in its amended form, when said report was improved and the [i-structions] adopted.

Page 81: "Meeting of Board of Directors held May 10, 1890.

"On motion of D. Van Wagenen, and seconded by Mr. Reymund, it was unanimously carried that the President order 200 water tickets printed. Water claims were then considered. On motion of D. Van Wagenen and seconded by Robey it was carried unanimously that the people be notified in public meeting that all having claims for more water than they are credited with must report them to the committee by the first of July next, after which date no attention will be paid to such claims.

Page 95: "At the meeting of the stockholders held on February 2, 1891, numerous claims presented by various persons as to water which they had been deprived of. On page 95 the following: "Mr. A. Wooten, St. stated on behalf of Mr. Bonner that Mr. Bonner was allowed on nine shares in Gerber Springs, and 25 in the Gurney

ditches. That as the investigating committee finds thirty acres under the Gurney ditch and two city lots, the company is safe in allowing the claim. On motion of A. Wooten, the claim was allowed. Joseph McCarrell's claim for ten shares was referred back to the investigating committee. Mr. A. Wooten stated that Mr. McCarrel was allowed all the water right to which he was justly entitled at the time of organization. William Van Wagenen's claim for five shares was referred.

A number of others are allowed and a number of others referred to the committee.

Page 99: "Meeting of directors held March 17, 1891. President Bronson stated the main object of the meeting was to make some arrangements concerning the waters off White Pine Creek as Mr. H. K. Newell and J. Shield, both of Park City have had the Island Lake recorded as [a *a* reservoir] which is the main feeder to Pine Creek, the waters of which they threatened to divert from their natural course and to supply Park City and vicinity."

380 Page 100: "On motion of Smith and seconded by Robey, James B. Wilson was elected to go to Park City and notify Mr. Henry Knewell and John Shields that this company have obtained legal advice that this company is entitled to the waters of Island Lake and that we protest against any and all party or parties interfering therewith."

Page 106: "Meeting of directors held May 5, 1891. "Directors' meeting of the Midway Irrigation Company called to order by president Bronson. Prayer by Wilson. President stated the object of the meeting was to consider the measuring of land. Moved by Wilson that two committees of three each be appointed to measure land under direction of the president, who shall furnish them with districts to be measured. President appointed Clayburn, Smith and Reymund for lower district, and Robey, Wilson, and Buehler for upper district."

Page 109: "Directors' meeting held July 6, 1891.

"President stated the object of the meeting was to consider the accounts of the measurements of the land, claiming stocks class A.

"On motion of Wilson and seconded by Buehler, the committee on measuring said land were instructed to compile their accounts immediately and submit the same to the Board of Directors at their various convenience.

"Meeting of Directors held July 20, 1891, same page.

"President stated the object of the meeting was to consider the right of Mr. N. Springer and U. Probst to the use of water from Snake Creek, it being reported that the above named parties are using water continuously.

"Wilson moved the appointment of a committee of two to wait upon Mr. Springer and learn what grounds he has to claim or use water from Snake Creek. Carried unanimously.

"President appointed Robey and Smith said Committee."

Page 111: "Meeting of Board of Directors held July 27, 1891.

"The committee, Robey and Smith that was appointed to visit Mr. N. Springer and U. Probst and turn the water they were using into creek, reported they had seen Mr. Springer, and turned the water from him and Mr. Probst and obtained a promise from
381 Mr. Springer to the effect that he, Springer, would not appropriate any more of the Snake Creek water to his use in the future. Smith moved that Mr. Robey go up to Mr. Springer's farm and see whether or not he has again taken any water from the above named creek."

"Meeting of directors held on August 10, 1891—same page. "Mr. Robey reported Mr. N. Springer still using the Snake Creek water, and that he, Robey, turned the water off for Mr. Springer into the creek, it having been reported that Mr. Springer has again taken said water and is using the same. Wilson moved that the President in company with Mr. Smith and Robey, go up to Mr. Springer's land, and if Snake Creek water is found there on, the President is hereby instructed to take immediate steps to prosecute Mr. Springer, as the law provides. Seconded by Buehler. Carried unanimously."

Page 117: "Meeting of Directors held on December 29, 1891.

"President Bronson stated that there were several items of business to present before the meeting, among them are disputed water claims and the collection of accounts from those outside of the company.

"Mr. Wilford Van Wagenen's claim for 25 acres class A water right, was discussed and for the lack of evidence, on motion of Wilson, reported to the committee with instructions to further investigate the matter and report at a future time, seconded by Buehler. Carried unanimously."

Page 121: "Meeting of Directors held January 11, 1892.

"President Bronson stated the object of the meeting as being to adjust some water claims, which remain unsettled. Mr. Wilson moved that Mr. Wilford Van Wagenen be allowed 15 shares Class "A" water right Seconded by F. Reymund.

"Mr. Clayborne moved that the above motion be deferred and that Mr. Van Wagenen's claim be referred back to the committee with instructions to receive testimony as to the amount of actually irrigated sufficiently to mature a crop. Seconded by Wilson. Carried unanimously.

Page 126: Meeting of Board of Directors held on February 2, 1892.

"President stated the business of the meeting was to adjust some water claims."

382 Then follows numerous claims presented by people claiming they were entitled to certain waters which they had not been getting. Page 139. "Meeting of Board of Directors held July 26, 1892.

"The President stated that the object of this meeting was to con-

sider the case of Mr. Springer taking water from Snake Creek whenever he pleases.

"Motioned by J. B. Wilson, seconded by F. Reymond that a committee of two be appointed by the Chair to visit Mr. Springer concerning this matter. Carried unanimously.

"The Chair appointed D. Van Wagenen and J. N. Buehler said committee."

Page 148: Meeting Board of Directors held May 17, 1893.

"Moved by D. L. Van that the time between *wratting* be from fifteen to twenty days. Carried."

Page 150: "Meeting of Board of Directors held on June 27, 1893."

"President A. Wooten stated the object of the meeting and read a statement of Mr. Sazey in regard to difficulty about the water rights between the mill owner and the water company. Moved by J. D. Wilson, seconded by T. Robey that a standing committee of two be appointed with power to act in regard to the present difficulty and all such that may arise. The motion carried. The president appointed A. J. Alexander and T. Roby said committee."

Page 159: Meeting of Board of Directors held January 10, 1894.

"Moved by William Coleman that A. J. Alexander and D. L. Van Wagenen Jr. be appointed to negotiate with the Ontario Company in regard to the White Pine waters. Carried."

Page 161: Meeting of the stockholders held March 12, 1894.

"Moved by J. D. Wilson that William Coleman be allowed five shares' increase of stock. Motion lost."

"Moved by D. L. Van Wagenen, seconded by A. J. Alexander, that the directors be authorized to consider the claims of William Colman, William Van Wagamen and John Murri for an increase of stock be considered and transfer rightfully belonging to the company."

Page 168: "Meeting of Board of Directors held April 23, 1894.—

383 "Question of amending capital stock was up "The president thought an amendment should be made concerning the classifying of stock and that class B men, might enter into an agreement by which such stock might be assessed for the purpose of increasing the water supply."

Page 176: "Meeting of Board of Directors held August 2, 1894: "President Wooten stated that the consideration of the water rights claimed by David Gibson was before the Board. Further on, that the propriety of joining Heber in obtaining an injunction prohibiting the Woodland people from appropriating more water from Provo River than was their right to do to the detriment of Heber and Midway interests.

"After some deliberation it was moved by A. J. Alexander and

seconded by T. Robey, that the Board recognized the right of David Gibson to the use of only seven acres, [th-t] is, to irrigate seven acres of land as it is commonly understood hereabouts; said waters to be supplied from Snake Creek. Carried unanimously."

Page 189: "This is a meeting of stockholders held on November 22, 1894. "In conjunction with R. C. Chambers Superintendent of the Ontario. The following proposition was made:

"Proposition to Honorable R. C. Chambers Superintendent Ontario Silver Mining Company."

"We the undersigned committee submit the following proposition, to-wit:

"That in lieu of the privilege of using the water of the Brimhall Island and Silver Lakes, situated in the so-called White Pine Canyon, now owned and used by the Midway Irrigation Company, the said Ontario Silver Mining Company deliver to the Said Midway Irrigation Company, at the head of this ditch, intersecting with the Provo River, one-third of the flow of water from the Ontario drain tunnel, which in no case shall be less than double the amount of water taken by the Ontario Silver Mining Company from the above said lakes, last named amounts being delivered at the mouth of the Provo River ditch, flowing into the so-called Gurney ditch. Further, that the said Ontario Silver Mining Company be to the expense of making, enlarging or changing all ditches necessitated by the proposed exchange of water, or in lieu thereof, a sum sufficient to indemnify the stockholders, which in our judgment, should be at least $5,000.00, to be paid to the Midway Irrigation Company.

384 "Signed by the committee for the Midway Irrigation Company."

Page 190: "Meeting of stockholders held November 24, 1894.

"D. L. Van Wagenen says: "There has been many mistakes made by this company in the attempt to get more water. He favored the payment to the people of $4,500.00 in order to be safe, so that no stockholder should ever be assessed on account of this exchange.

"Final agreement on page 192.

"This agreement and grant made November 24, 1894, between, the Ontario Silver Mining Company, a corporation, organized and existing under the laws of California, and the Daly Mining Company, a corporation organized and existing under the laws of Utah, as first parties, and the Midway Irrigation Company, a corporation. Duly organized and existing under and by virtue of the laws of Utah, as second party thereto, witnesseth:

"The second party has heretofore continuously operated, diverted and used and licensed the use of farming lands, for agricultural, stock and culinary [used] and purposes, of all the water flowing from what are known as and called the Silver Islet Lake, Silver Lake

and Brimhall Lake, all in Snake Creek mining district, Wasatch county, Utah, and is now appropriating, diverting and using and licensing the use of same farms for said purposes. The first party, the Ontario Silver Mining Company, has developed, appropriated and is now using for various purposes a flow of water from its drain tunnel, on as and called the Ontario drain tunnel, No. 2, the mouth of which is in the Blue Ledge Mining District, same county, and which extends to the Ontario No. 2 main shaft of the Ontario mines in Uintah Mining District, Summit County, Utah; the first party, the Ontario Silver Mining Company, hereby grants, bargains and conveys to the second party hereto, and to its successors and assigns forever, the said waters and the right to divert, appropriate and use, and license the use on the same farms and for the same purposes aforesaid, the said water flowing and to flow from said drain tunnel, up to a quantity equal to, but no more than one-third of the continuous flow on said drain tunnel, and said first party, the Ontario Silver Mining Company, agrees to deliver said water, hereby granted, to the second party at that point in the bed of the Provo River immediately above the present dam of the second party, in said
385 river, known as the Midway dam, and the second party shall take care of its own dam and ditches and other ap-urtenances for diverting and using the water; and in consideration of said grant, by said Ontario Silver Mining Company, the second party hereto hereby grants, bargains and conveys to the first parties hereto, and to their successors and assigns forever, all the waters flowing and to flow from said Three Lakes and the right to divert, appropriate and use same by such means and at such points on or below said lakes, and for such uses and purposes as to the first party, its successors and assigns may seem proper, and provided the said one-third flow of said water from said drain tunnel, shall at any time in the future diminish to less than twice the amount of water taken from the aforesaid lakes, by the said Ontario and Daly Mining Companies, said Ontario and Daly Mining Companies, hereby agree to furnish to the said Midway Irrigation Company, in the said ditch known as the Liver Ditch where it empties into the Gurney Ditch, twice the amount of water taken from said lakes.

This agreement is made in consideration of the sum of $4,500.00 paid to the said Midway Irrigation Company by the aforesaid mining companies, the receipt of which is hereby acknowledged by the President and Board of Directors of the Midway Irrigation Company, as well as by a majority of the stockholders.

Witness the names and corporate seals of the parties, dated November 24, 1894, at Midway, Utah."

Signed by the Mining companies and signed by the stockholders of the Midway Irrigation Company, giving the number of shares of stock held by each.

Page 218: Meeting of Board of Directors held July 22, 1895.

"President Wooten reported interview with R. C. Chambers regarding the tunnel water, as the Heber people had about shut off

that water from the Midway Canal. Mr. Chambers seems to be determined to protect the interest of the Midway Irrigation Company concerning the tunnel water."

Page 219: Meeting of Board held July 31, 1895.

"Moved by T. Tobey, second by William Coleman that the stream of water flowing to the residence of James W. Provost, David Provost and Wilford Van Wagenen, also one surplus stream on the east of Mrs. O'Neill's residence, be discontinued during the
386 irrigation season and that the watermaster be so instructed. Carried unanimously."

Page 219: Meeting of Board held August 13, 1895.

"Prayer by A. J. Alexander. President Wooten stated that the main business before the Board this evening was in relation to the business which was attended to at a meeting held at Heber regarding the right to the waters of Provo River. He further stated that the results of said meeting were that the claims for water from Provo River should be reported to three attorneys and the matter left to a Court of Competency for its adjudication."

Page 328: Meeting of Board of Directors held August 13, 1903.

"The president states that the object of the meeting was to take into consideration the case of C. A. Springer who claims the right to divert the waters of Snake Creek at the high dugway.

"Moved by Hauter, seconded — Francom that suit be commenced against C. A. Springer to quiet his title to the water of Snake Creek which he claims. Carried.

Page 329: Meeting of Board—does not give the date.

"Moved by Fred Haueter, seconded by Jed Francom that a committee of two be elected to investigate the rights (if any) of C. A. Springer of using water from Snake Creek for irrigation purposes, and report in writing at some future meeting.

"Committee elected. J. W. Buehler and Hugh Coleman."

Page 344: Meeting of Board of Directors held July 12, 1904.

"Moved by John Murri seconded by Fred Hasler that President John U. Buehler be authorized to enter suit against James T. Wilson for stealing water from the River ditch. Motion Carried."

Page 344: Meeting of Board held on July 29, 1904.

"Moved by John Murri seconded by John Clayborne that a committee [b*y*] appointed to investigate N. C. Springer's right to use the water of Snake Creek for irrigation purposes.

Page 361: Meeting held on July 10, 1905.

"Moved by John Clayborne seconded by G. Buehler that John Murri be appointed to wait also upon C. A. Springer. Motion carried.

387 Page 369: Meeting of Board of Directors held December 19, 1905.

"The C. A. Springer committee was reported by Haueter and Murri. The Co. Water Commissioners, O. J. Call, measurement of C. A. Springer's water was ordered recorded. The amount used by him was .66 second feet. J. U. Probst stated that we offered him, Springer, six shares of stock in Midway Irrigation Company, or accept his own proposition, viz; to take the amount of water he was then using, .66 second feet, three different times during the irrigation season for three days and nights in succession each time. Springer agreed to consider the proposition and let the company know before the annual meeting. Report accepted.

Page 233: Meeting of [*Baord*] held March 4, 1896.

"J. Probst further proposed to embody in or add to the [i-structions] to watermasters the following: and that the watermasters make reports as may be called for the Board, [*the*] and at the expiration of his term of office (one year) deliver use to the company. Seconded by William Coleman and carried unanimously, J. T. Willson agreeing.

Page 242: Meeting of stockholders held on January 4, 1897 that was simply to show that W. Van Wagenen was elected president at this annual stockholders' meeting. That was one of the times when he was elected.

Page 246: "Meeting of Board held March 6, 1897.

"Moved by Williams, seconded by J. W. Bates, that the Board invite bids for the position of watermasters under the same instructions which prevailed in 1896. Carried unani-ously The secretary was instructed to post notices corresponding with the foregoing action of the Board, the time for presenting applications to be lim--ted to March 20, 1897.

"Decided by tickets for water be issued, beginnings with the 24th day of May next.

Page 253: Meeting of Board held August 6, 1897.

"President Van Wagenen presented that the business before the Board was in regard to the general adjustment of water rights in Provo River and other water not yet appropriated, if any there be, by the District Court. The plaintiffs were the various companies across the river, who use water from the Provo River. The complaints entered by the Heber and Charleston Irrigation Companies

were read by the Clerk. Moved by J. Probst, seconded by Williams, that the President confer with the attorneys at Heber, re-
388 garding the answer to the above named complaint tomorrow. Carried."

Page 260: Meeting of Stockholders held February 16, 1898.

"Moved by J. B. Wilson, seconded by B. M. Smith that a committee of two be appointed by the President for the purpose of waiting upon Mr. Chambers when convenient to do so, without incurring much expense regarding the leasing of more water for a year or so. Carried.

Page 268: Meeting of Board held July 9, 1898.

Prayer by F. Reymund. "Claims for water in Provo River were considered. Andreas Burger having been authorized by President J. A. Wooten to look after the flow of water in the River Ditch, reported that on July 7, about 10 o'clock A. M. he found the ditch dry, the water having been turned into the Watch canal, with the exception of the seepage. Below the Wasatch Canal Isaac Baum had a stream out also.

"President Wooten stated that the Heber and Charleston people complained of Midway taking too much water from the river; they desired to have a conference with the Midway people, next Monday, July 11, 1898."

Andrew Burger was appointed to look after Midway's interest concerning the flow of water in the River Ditch

"Moved by J. Provst, seconded by G. Buehler, that a committee of two be appointed or elected to represent the Midway Irrigation Company at a conference on July 11, Carried unanimously. Upon motion duly made and seconded James B. Wilson and J. A. Wooten were elected for said committee by unanimous vote."

Page 291: This is a meeting held July 2, 1900, by the Midway Irrigation Company and the Charleston people and Heber people concerning distributing water.

"J. R. Murdock said that about two weeks ago we measured the water in the river and found that we were short from 25 to 30 cubic feet. We went above, all along the river, and turned more water down from the various streams. We went to the Midway dam where five and a half feet of water should run in. We measured the water and found the other day that there were five and half feet there, and three feet more, the latter amount being in excess of water off from Midway from Midway dam last Sunday but it was thought to wait a day or two longer to see what would be done without bringing the matter into the courts."

389 Page 292: Same Meeting, at the conclusion.

"The members of the Board then among themselves and as a matter of a basis for the committee to work on, agreed that they

would take *th*en cubic feet per second or five and half feet of tunnel water, and four a half feet of seepage after July 1, each year, that is, during low water season, otherwise all the high water will justify."

Page 298: Stockholders Meeting held February 25, 1901.

"To the Honorable Board of Directors of the Midway Irrigation Company. Gentlemen: Your committee elected to investigate the waters of White Pine Creek beg leave to report as follows: We visited the same during the months of July and August, and in Judgment the stock under White Pine creek are not receiving the amount of water due them. Signed Wilford Van Wagenen, S. H. Epperson, John Murri."

"Upon motion made, seconded and carried, the report was accepted and the committee discharged."

"J. B. Wilson, in speaking upon the business of the Midway Irrigation Company explained that the White Pine Creek did not furnish sufficient water for the stock under it."

"John Murri corroborated again the report of committee. S. H. Epperson on the 2nd of August, 1900, found no water in Pine Creek but he, himself, could not, with 27 shares of stock irrigate fully four acres of lucern on the bench. Said the old settlers had been robbed of the water rights. About July 15, 1900, he found about one-half stream of water in Pine Creek. On August 2nd, after he found none. Was in favor of paying J. B. Wilson what was right and cancel such stock.

"John Murri stated that on July 8, 1900, there was about enough water at the crossing to make a good irrigation stream. The water could be brought down in flumes, as much of it wastes. Ulrich Abbeglen stated the same as Mr. Murri.

J. B. Wilson: "I want to serve notice on the Midway Irrigation Company that the experimental station is passed. I will leave matters to arbitration. I accept this. I offer you 100 shares of stock for $700.00. I value my interest in Pine Creek [*eater*] at $1,300.00 as I think my farm and water *is* worth $2,000.00. I offer you the whole for $2,000.00. Any proposition that gives us the Pine Creek water we will consider.

390 "It was moved by G. A. Huntington, seconded by J. B. Wilson that we adjourn until 7:30 in the evening."

"That evening, meeting continued on page 300.

"It was moved by C. Peterson, seconded by J. Murri that a committee of three be appointed to confer with the parties interested in Pine Creek, whether they are willing to go in with J. B. Wilson and F. Reymund in this proposition to the company and to release the company from all further responsibility. And that said committee report to the stockholders' meeting to be adjourned to March 11, 1901, at 1 O'clock P. M. at this place. Motion carried unanimously.

Page 305: Special meeting of Board held July 6, 1901.

"It was moved by F. Haueter, seconded by J. B. Wilson that a committee of two be appointed to see to the amount of water flowing to the dam of the New River Ditch and be empowered to take steps to obtain the amount of water due the company. Carried.

"The Chair Appointed John U. Buehler, and J. B. Wilson such Committee.

"It was moved by J. B. Wilson, seconded by S. Street that the president be authorized to appoint a committee of seven from the stockholders of the Midway Irrigation Company to investigate the amount of water. Carried."

Page 311: Meeting of stockholders held January 25, 1902.

"It was moved by J. B. Wilson, seconded by B. M. Smith that we take legal advice in regard to taking high water from Provo River for the use of a reservoir to be constructed and that a committee of three be appointed for this purpose to report to the stockholders at their convenience. The motion carried. Ayes 25, noes eight. The chairman stated the result as above given. The [chari] appointed Henry T. Coleman, A. J. Alexander and Wilford Van Wagenen such committee."

Page 313: Meeting of the Board held March 12, 1902.

"Moved by J. B. Wilson, seconded by Haueter that the watermaster be instructed to issue tickets not later than the 15th of April, beginning from top of ditch downward, unless two-thirds of the stockholders wish the water in a reverse order. Carried unanimously."

Page 314: Meeting of the Board held April 9, 1902.

391 "Willford Van Wagenen Presiding. Prayer was offered by J. B. Wilson.

"On motion of S. H. Epperson that the bid of Daniel H. Wilson to act as watermaster on the west side of Snake Creek for the season of 1902, for $75.00 be accepted. Carried unanimously."

"On motion of F. Haueter, seconded by F. Barber that a committee of two be appointed to confer with superintendent Rood of the Ontario Silver Mining Company to see on what terms the balance of the tunnel water can be leased or purchased; and that said committee be empowered to make an offer not to exceed $200.00 for the use of the remaining two-thirds of the said tunnel water for the [ensuring] year.

Meeting of Board held on May 14, 1902, same page.

"The committee on the leasing or purchasing the balance two-thirds of the tunnel water reported per J. B. Wilson, who stated that the committee had seen superintendent Rood at Park City and offered him $200.00 for the said water. This did not seem to be sufficient to suit Superintendent Rood who promised to first give

the matter his further consideration. The report was accepted and the committee released."

Page 315: Special meeting of Board held May 20, 1902.

"J. B. Wilson reported that a dam could be made in Mahogany Spring below where the old ditch heads and a ditch could be made from that dam. Recommended that the work be done.

"President W. Van Wagenen stated that he had an interview with attorney Snyder and thought that the Ontario Mine would rather deal with the Midway regarding this surplus tunnel water than with anyone else.

"It was moved by H. C. Coleman and seconded by F. Haueter that the Chair appoint a committee of three on the matter of a deal for water from the Ontario drain tunnel. [*Morion*] carried unanimously."

Page 316: Meeting of Board held October 15, 1902.

"It was moved by J. B. Wilson, seconded by Haueter that one member of the Board be appointed and in connection with the secretary collect statistics concerning the flow of water during the low water season. Carried."

392 "F. Haueter was appointed to take observation of the waters of Snake Creek in connection with the secretary. Adjourned until second Wednesday in November."

Special Meeting of Board, November."

"J. B. Wilson moved that a committee of three be appointed to attend a meeting of the canal companies at Heber on November 10, 1902, at seven o'clock p. m. to see upon what condition the Midway Irrigation Company can receive stock in the proposed corporation, to increase the waters at the head of Provo River, and that the said committee be empowered to call a meeting of the stockholders to report their findings. Motion was seconded by F. Haueter and carried by unanimous vote."

Page 316: Meeting of Board held November 12, 1902.

"J. B. Wilson reported findings concerning water at the head of Provo River. The feeling among the canal companies at Heber seems to be to let Midway have perhaps about eight hundred shares of stock at $2.00 each. The secretary was authorized to call a stockholders' meeting per printed postal cards for Nov. 29, 1902, at 7:30 o'clock at the Swiss Hall in Midway for the purpose of considering the proposition of reservoiring the water at the head of Provo River in common with other irrigation companies.

Page 352: Meeting of Board of Directors held March 4, 1905.

"Moved by J. W. Francom, seconded by F. Hasler, that a committee of two be appointed to negotiate with the Ontario Mining Company for the surplus tunnel water.

Page 353: Meeting held on March 9, 1905.

"The committee to negotiate with the Ontario Mining Company gave their report as follows: Given by F. Hasler. Superintendent Rood of Ontario Mining Company wanted the Irrigation Company to give them a written proposition which could be presented in court if necessary.

"Moved by John Murri, seconded by Fred Hasler, that we accept the report of the committee. Motion carried. Moved by F. Hasler and seconded by John Murri, that the secretary be instructed to write a letter to superintendent Rood agreeing to pay $5,000.00 for the balance of the tunnel water delivered at the River Ditch head-gate. Carried."

Page 360: Meeting of Board of Directors held July 8, 1905.

393 "Moved by C. I. Bronson, seconded by James W. Provost that the Board of Directors of Midway Irrigation Company be appointed as a committee to estimate the loss sustained by the company by the loss of five and one-half second feet tunnel water. Carried."

Mr. MacMillan: I read that to show that this offer of $5,000.0 was made prior to the loss prior to the caving of the Ontario Tun-nel which has been testified to.

Page 367: Meeting of Board of Directors held November 1, 1905

"President stated purpose of meeting was to consider the Daly-West Mining Company taking the Lavina Spring water. Gotlieb Buehler stater that he and Fred Haueter had visited the Daly-West mill superintendent, Mr. Sherman, who informed them that he would consult the head parties in Salt Lake City and inform the Directors.

"Moved by J. W. Francom, seconded by John Clayborne that we have our attorney enter protest with State Engineer against the Daly-West Mining Company to prohibit them from taking water of Lavina Spring without permission, carried unanimously."

Page 386: Meeting of Board held March 15, 1907.

"Moved by Jacobs, seconded by W. W. Wilson, that we advertise for bids for the position of watermaster who should supervise the distribution of all the water under the direction of the Midway Irrigation Company, tickets for water to be issued for the season beginning with the 15th day of April, and if needed to continue until the 15th day of September, 1907. The motion carried unani-mously."

Page 397: Meeting of Board held on October 26, 1908.

"Upon motion made by Jacobs, seconded by Buehler, the Presi-dent was authorized to interview Bamberger, superintendent of On-tario and Daly mines in regard to a possible deal for water from the drain tunnel.

Page 398: Meeting of [Baord] of Directors held on January 30, 1909.

"President Van Wagenen reported that Heber City had already leased the tunnel water at a much higher figure than the Midway people could or would pay.

"Regarding making good the loss of water during the year when
none could come through the tunnel on account of it having
394 caved in, Bamberger said he would entertain any obligations
as to that loss to the farmers of Midway. The President's
report was accepted."

Mr. MacMillan: I will read now from the minutes of the Midway Irrigation Company in the book beginning January, 1912.

Page 9. Meeting of Board of Directors June 29, 1912.

"President Ross presiding stated there were several items to be taken up. Read a letter from George Barzee in regard to turning what water the Snake Creek Tunnel claims down Snake Creek Channel.

"Moved by J. B. Wilson that R. B. Ross be authorized to meet Mr. Barzee and inform him of our previous offer by letter on two occasions to negotiate with them in regard to their rights in the waters [*if*] Snake Creek and further that the Board of Directors had authorized for the year 1912 that any surplus waters over and above the measurement of Snake Creek and its tributaries for the year 1911, be surrendered to said company to flow down the channel of Snake creek at their expense and that a committee stood ready to meet them."

Page 11: Midway July 10, 1912.

"Meeting of Board. Pres. Ross presiding.

"[Pres*ne*t] of Board Ross. W. W. Wilson, J. C. Wilson August Kohler, Bronson, Murri, Probst.

"President stated that the objects of the meeting were to hear report of committee to measure water and to consider the turning of waters down the creek from the Mountain Lake Tunnel and also from Snake Creek Tunnel.

"President Ross stated that on the advice of the attorney he turned back water which Commissioner Barzee had turned down for the Mountain Lake Co. and on motion of J. B. Wilson that action was approved.

"Moved by John Murri that an agreement made between Pres. Ross and Mr. Lambourne of the Snake Creek Tunnel Co. the said Co. to have two-thirds of the water now flowing from the tunnel less 10% for evaporation. Said agreement to last until the 28th inst. when a permanent agreement may be made.

"Motion approved.

395 "Moved by W. W. Wilson that President Ross be authorized
to offer 4 second feet at the head of the river ditch from the river water in lieu of the two-thirds of the Snake Creek Tunnel water and its loss by evaporation. This to last to the 28th inst.

"Said offer to be made to the Provo Reservoir Company who have leased that water from the tunnel Company. Carried."

Page 12, Midway August 3, 1912.

"Meeting of Board. Members present Ross, Probst, W. W. Wilson and Bronson.

"President stated that the object of the meeting was to consider the exchange of River Ditch water for Snake Creek Tunnel water.

"Moved by W. W. Wilson, seconded by Bronson, that the exchange above be made for the current year as a demand has been made by the Snake Creek Tunnel Company for the water flowing from their tunnel. Carried."

Page 18: Midway, December 30, 1912. Meeting of the Board of Directors.

"Moved by J. B. Wilson, that a committee of one be appointed to go down and confer with Mr. Lambourne in regard to renting water of the Snake Creek Tunnel Company for the year 1913."

Page 19: Midway, Jan. 13, 1913. Annual meeting of stockholders of the Midway Irrigation Co. held in German Hall.

"Acting President Murri stated object of the meeting was to consider renting Snake Creek Water, hear report of secretary and treasurer and elect new officers as follows:"

"Continuing on page 20: J. B. Wilson's report in regard to the Snake Creek water was as follows: Lambourne would give the Irrigation Company preference to the water at the rate they could get it elsewhere, would not rent for more than one year until they developed the tunnel. Said he had had an offer of from $50 to $100 a second foot to be measured when at normal flow.

"Moved by Wilson that we offer $500.00 for the year 1913, to the Snake Creek Tunnel Co. for all the water. Called to stock vote. Three tellers appointed by the Chair, W. W. Wilson, Geo. Huntington, J. Buehler, tellers. Vote 709 yes, 749 no. Adjourned."

396 Page 24: Meeting of Board May 24, 1913.

"President Jas. B. Wilson presiding. Present A. L. Alder, Geo. Huntington, A. Kohler, J. R. Murdock.

"Object of meeting was to renew contract between Midway Irrigation Company and Provo Reservoir in regard to exchange of Snake Creek Tunnel water for river ditch water and the distribution of water from River into Island Ditch

"Moved by A. L. Alder that as a trial for season of 1913, seven and one-half second feet be accepted for use in the Island Ditch. Seconded by Geo. Huntington, motion carried.

"Moved by Geo. Huntington, seconded by Wm. Bonner that a committee of three be appointed to negotiate with Smith, Ford and Johnson in regard to use of River water in connection with Dutch field people, and in service received from water in the exchange of eight second feet of River Ditch water for Snake Creek Tunnel water. Motion carried."

Page 26: Meeting of Board of Directors June 17, 1913.

"President Wilson stated that the object of the meeting was to consider the exchange of water with Snake Creek Tunnel Company.

"Moved by Huntington, seconded by Bonner, that we acknowledge the right of Snake Creek Tunnel Company to water which they may have developed. Motion carried.

"President at meeting, Wilson, Probst, Alder, Kohler, Bonner, Bronson, Huntington."

Page 29: Special meeting of stockholders held on July 2, 1913.

"Moved by Jos. Jacobs, seconded by Simon Epperson that the water right of the Snake Creek Tunnel Co. as recognized by Board of Directors of the Midway Irrigation Company, be turned down the Snake Creek until a committee report at a meeting to be held one week from tonight.

"Amendment on motion by Jacob Probst seconded by John Wooten that we leave the water as it is now adjusted until we hear the report of the committee in this building one week from tonight. Motion by acclamation carried."

397 Page 31. Stockholders' meeting as per adjournment held on June 9, 1913.

"Moved by George A. Huntington, seconded by A. L. Alder, that we do recognize and allow under protest the Snake Creek Tunnel Company the use of the water, less evaporation and seepage, now flowing from their tunnel. Teller John A. Wooten, A. L. Alder, J. R. Murdock. Motion Carried with a majority vote of 143."

Wilford Van Wagenen recalled by the plaintiff for further cross examination, testified in substance as follows:

The A. L. Alder mentioned in the minutes of the meetings which have been read is the Alfred L. Alder that had testified. He was a director of the company.

Mr. MacMillan: May the record show the Ontario Drain Tunnel caved on March 25th, 1903, at 6 P. M. That upon it being opened the water was tapped in March, 1908, and the tunnel reopened in May, 1908.

Mr. Wedgwood: If you say that is a fact, I will take your word for it.

G. R. McKay, recalled by the defendants for further cross examination, testified in substance as follows:

I was a witness at the other trial. [Possible] I testified to some matters in that trial as to which I have not testified in this. I have not read it over, I do not know.

Q. Then you are reported as testifying as follows. This following question was asked you: "That shows, does it not, comparing that measurement made in August with the measurement of the

Mountain Lake Tunnel you made in August, according to the flow that you have given, Snake Creek lost .02 of a second foot between the two points, or .2 of a second foot." That question was put to you was it not?

A. Yes, I presume so.

Q. And your answer was "That is approximately right."

A. Yes.

Q. And according to those measurements between the Mountain Lake Tunnel, and the point where you measured on Snake Creek figuring exactly Snake Creek lost .25 of a cubic foot per second by those measurements between Mountain Lake Tunnel and the point
where you measured it, opposite the Snake Creek Tunnel, the
398 Figures being 8.70 and 8.45. That would be correct,
wouldn't it?

A. Yes.

Q. My question to you "What?" Answer "That is about right. Question. "Now then how far is it from Snake Creek to Mountain Lake Tunnel, down to the point of this measurement? Answer. "Probably two miles and a half." That is correct, is it not?

A. Yes.

Q. "Probably two miles and a half." What is the fall in that two miles and a half of Snake Creek? Your answer "About 1,800 feet I believe." Is that answer correct?

A. Approximately.

Q. "More than six hundred feet to the mile?" A. Yes, sir." Is that correct?

A. Yes, sir.

Q. "Now then did you say you made an October measurement." Your answer was "yes, sir." Is that correct?

A. I suppose so.

* * * * * * *

Q. "Now, what was the difference between the Mountain Lake Tunnel and Snake Creek in that October measurement?" Look it up and give it exactly."

Your answer "The measurements on the Mountain Lake Tunnel in October, was 5.26."

Q. "Well, that would show that at that time Snake Creek lost practically .34 of a second foot?"

A. Yes, sir."

Q. "Going down two miles and a half with a grade of more than 600 feet to the mile. That is practically on the rock, on bed rock, is it not, down that distance?"

A. No, not by any means. There are certain places where the flow is very rapid, where the creek is running right directly on bed rock, but in other places it is filled in to the extent—well, in some places of ten feet that I know of." Do you want to change that testimony in any way?

A. No.

Q. Now, then, as a fact, the October measurements that you made

and testified to, show that instead of thirty-five, the Snake Creek lost between the Mountain Lake tunnel and the point of measurement of the Snake Creek Tunnel .36 of a cubic foot per second as you answered me here?

A. Yes.

Q. "Very few where it runs on bed rock and they are comparatively short. So that for a good portion of Snake Creek, you say, it is refilled canyon that has a sub-surface flow?"

A. "Yes sir."

Q. "Is the surface loss in one of these places .35 of a second foot, and the other .2 of a second foot?"

A. "Yes, sir." Turning to the next page.

399 "Q. Ever noticed any streams flowing into Snake Creek from the Mountain Lake or the Snake Creek tunnel?"

A. "Yes, sir, small streams."

Q. "How many would you say?"

A. "Oh, two that I remember of distinctly."

Q. "Two, is that all you remember?"

A. "Above the Snake Creek Tunnel."

[—.] "Is that all you remember of, Mr. McKay?"

A. "I think that is all. There are a number of dry gulches there where water has run down."

Q. "Would you say that two streams are all there is that flows in?"

A. "That is, I believe that is all I have seen."

The Witness: Now, in addition to the loss shown by these measurements at the Mountain Lake tunnel and the point opposite the Snake Creek tunnel, there would be an additional loss of whatever the surface streams were flowing in there. If there were two as I say I know of, and I have never been up the canyon very much, whatever was flowing in them would be lost. If there were four streams flowing in, whatever would be flowing in them would be lost and if Snake Creek had any accretions coming out of the rocks, that was also lost.

There is no measurement shown on the hydrograph of the Mountain Lake tunnel for October 29, 1914. The loss as shown of .36 of a cubic foot per second independent of any surface flow, is not shown upon the hydrograph 142 of the Mountain Lake tunnel. I have placed a dot with a small circle around it in black pencil mark at 5.26 for October 29th.

I testified that the only place where water came into the tunnel from the bedding planes, except as to what drips from the roof where the tunnel cuts the bedding planes on their dip was at the point 7,555 feet in for a space of about twenty feet and the dip of that strata was to the west.

Q. And you also testified and it is a fact that [taking] altogether that 600 feet of roof would cover all the area from which water drips from the bedding plane, did you not?

A. I suppose I did.

Q. That is right, isn't it?

A. I don't know, I haven't thought of that for a long time.
Q. You do not dispute but what——
A. I presume I figured it up at the time I testified.

Q. Page 1080:
Q. "There are only four or five places and they are the limited area where there is any water in drips coming from the roof, is there?"
And your answer "Well, if you extend these area- to a large enough extent, that would probably include most of them."
Q. "Four or five places, that is, dripping directly from the bedding planes?"
A. "Dripping from the roof."
Q. "In that total area of 10,600, would be only about 600
400 feet?"
A. "Approximately that."
Q. "And with the exception of one place where there appeared to be a fracture or something of that kind in the roof, with simply occasional drips coming down?"
A. "I would not call that one place particularly."
Q. "Well, it is where, one place with boards or something of that kind."
A. "I understand what you mean, yes."
Q. "At this point 7,555 feet in, you say the opening is about ten feet long?"
A. "Yes, extending along the bedding planes for about ten feet."
Q. "Now, does it drip from a horizontal?"
A. "It does."
Q. "How high is it from the floor?"
A. "The dip is about due west at that point."
Q. "It is due west?"
A. "Yes, sir."
Q. "Is that the dip of the strata there?"
A. "Dip at that point."
Q. "Due west at [th-t] point?"
A. "Yes sir."
Q. "And not north?"
A. "No."
Q. "In other words, you cut right through an opening in the lime rock?"
A. "Yes, sir."
Q. "You say it is about ten feet on either side of the tunnel?"
A. "Yes, sir."
Q. "How high is it from the floor at the end of the ten feet on the face, towards the face?"
A. "About three feet."
Q. "About three feet. In ten feet it dips down a foot?"
A. "Practically that. It is about 35 degrees in a west direction."
Q. "You cut right across it and through it with that tunnel?"
A. "Yes, sir."
Q. "Now did that carry any water?"
A. "Yes, sir, there was water dripping out of it."

Q. "Water just trickling out of it, did not carry any substantial stream of water?"

A. "It does not now. I don't know what it was when it was first cut."

Q. "Do you desire to change that testimony in any way?

A. No.

Exhibit 34 received in evidence.

O. N. Friendly, recalled by the defendants for further cross-examination, testified in substance as follows:

Mr. Wedgwood: The Mountain Lake Case has been referred to and plats made of it and the testimony referred to. It was stipulated in the other trial it might be considered as in the case.

Mr. MacMillan: It has been so stipulated in this trial.

Mr. Wedgwood: I want to read a portion of certain things. I read from page two of the abstract of the complaint; I want to ask Mr. Friendly a question about it.

(Reads:) "3. That plaintiff is now and at all of the times hereinafter mentioned has been engaged in the business of owning, developing and operating its mines and mining claims in Wasatch,
401 Utah and Salt Lake Counties, State of Utah, and the draining of water therefrom and utilizing such water for beneficial purposes, and that in about the year A. D. 1900, plaintiff's predecessors in interest, for the purposes aforesaid commenced an underground tunnel in and upon its mining claims aforesaid and from and since said date have continued until the plaintiff now has completed such tunnel for a distance of approximately one mile, all within the mining claims and property of this plaintiff, and that out of said tunnel there is now issuing a large quantity of water, to-wit, about fourteen second feet, all of which comes from seepage in its said tunnel and other underground sources, all of which said water is collected and developed by the said tunnel and in and from the mining claims and properties of the plaintiff by means of said tunnel, and all of which said water, other than about one-fourth thereof, had not, theretofore found its way to the surface of the earth so as to become a tributary to any known surface stream or watercourse."

The complaint was filed August 8, 1910. They alleged there was 14 cubic feet per second. From the findings of fact I will read the fourth, found on page 214.

"4. That the predecessors in interest of the plaintiff, in about the year 1898, commenced a tunnel in and upon its mining claims in Wasatch County, in the State of Utah, near the head of what is known as Snake Creek, said tunnel being known as the Mountain Lake Tunnel, and that the said predecessors of plaintiff and the plaintiff from and since said date have continued the driving of said tunnel until it is now completed for a distance of approximately one mile, wholly within the mining claims and property of the plaintiff corporation, and that out of said tunnel there is now issuing a large quantity of water, to-wit: About eight second feet, all of

which comes from seepage in the said tunnel and other underground sources, and all of which said water is collected and all thereof except 3½ second feet was and is wholly developed by said tunnel and in and from the mining claims and properties of the plaintiff by means of said tunnel and all of which said water, other than three and one-half second feet thereof, [*ah*d] not theretofore found its way to the surface of the earth so as to become a tributary to any known surface stream or water course."

Reading from the seventh finding of fact, page 217:

402 "That in the channel of Snake Creek and in the vicinity of sad tunnel, were located several springs which had theretofore formed a part of the permanent source of supply of said creek; that when said large quantity of water was struck at and near the Buehler's switch continued to flow at approximately the same quantity as had theretofore issued from all of said springs, except that, as the tunnel was driven into the mountain from the said Buehler's switch, and the water was struck further on in the tunnel, the flow of water was diminished to some extent at and near said Buehler's switch, and that said springs thus dried up have since said time remained permanently dry, and the water from the said tunnel has continued to flow; that the springs thus dried up were from three to six in number, and that the said springs were fed by an underground water course, and that said springs, before being cut off and dried up by the driving of the said tunnel, formed a portion of three and one-half second feet, and that in driving of said tunnel, wholly within the lands and mining claims of plaintiff.

Then the decree follows. Done this 30th day of July, 1912.

Q. Will you kindly step to hydrograph 142 and give me the period of time in the year 1914 and 1915, from the measurements made by your people,—when I say 1914 I mean the part of 1914 and the early [—] of 1915 when there was not 3.50 cubic feet of water flowing from said tunnel all told, that is, from what date to what date?

A. During the month of May there was not, and in all probability there was not during the winter months just prior to the month of May.

* * * * * * *

Q. Is there any objection to answering me if it is a fact that according to the hydrograph the months of December, January, February, March, April, May and at least 10 days in June, 1914 and 1915, there was less than 3.50 cubic feet per second of water flowing from Snake Creek, tunnel?

A. That is probably true.

Q. And the year 1915 and 1916 from the middle of September from the 20th of September of 1915 up until the 15th of June, 1916, there was less than 3.50 cubic feet of water per second flowing from Snake Creek tunnel?

A. There probably was but I don't know it as a fact.

Q. As shown by the hydrograph itself?

A. As shown by the curve, yes; not by the measurements except in the case of September.

403 Q. I don't want to go into this but you force me to. Do you say now that there is no reliability at all to be placed upon the hydrograph 142?

A. No. I said it was probably true; that is as far as I can go.

Q. You have shown it to be true by the hydrograph, haven't you?

A. To be probably true, yes.

Q. In 1916 and 1917, that is, the latter part of 1916-1917 from the first of January up until the 5th of June, there was less than three cubic feet per second of water flow as shown by the hydrograph, was there not.

A. Yes, as shown by the curve.

Q. And from December 1917 up to about the 10th of May, 1918, shows less than 3.50 cubic feet per second flow from the tunnel?

A Yes.

The Witness: I have shown the line where section 187 is cut on Exhibit 173. The two limits of the projection are marked with a green arrow on the lower horizontal line in the Exhibit 172 and underneath those ar-ows marked "187". The lineal length would be a little over 16,000 feet, something like three miles. You are facing the same way on both hydrographs.

I have marked the judge tunnel on Exhibit 173. It is the tunnel that is projected fartherest to the left or southwest on Exhibit 173.

On Exhibit 187 I have marked a line "Anchor Tunnel". That is the same tunnel. If it corresponded properly that would be the fartherest workings to the southwest. There is a slight discrepancy. It is the projection that makes them look that way. From the face of the Judge tunnel, [other*e*wise] known as the Anchor tunnel, in the two exhibits from my best approximation, the actual distance from the southwest limits on Exhibits 187 to the west limits of 173 *on* 187 is about 3,800 feet. So far as the 3,800 feet is concerned either upon Exhibit 187 or 173, it is ideal except that we have some surface workings over that area which are not shown. Several of those surface workings are in diorite. I do not know that they all are. They are mostly shallow shafts. There is one that is about 130 feet in depth from the surface in that area in the [di*r*orite].

I have identified the limits of the plane on 187 upon 115. It is marked with a black pencil line extending the Anchor tunnel and marked 187. On 187 and 173 these lines converge but never cross each other.

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I agree with Mr. Boutwell that the greater force and effect of the great movement that the country adjacent to Park City has been subjected is shown and developed along the axis of the anticline which runs from Clayton Peak to Ontario No. 3 shaft and on further. Formations are taken from other beds and piled on top of other formations and shifted a couple of miles; they were faulted to a very marked degree.

In the Snake Creek tunnel there were fissures and openings as I have indicated upon 139 to the number of a great many hundreds, of different sizes. I would not say that they all lie approximately parallel to this line of movement. I have indicated them substantially correct on Exhibit 139. As they are indicated a portion of them run almost parallel to the line of the great movement I speak of and as I have stated, they run very nearly perpendicular, some dip one way and some another. A great many of them dip towards the portal of the tunnel, cutting the bedding planes. These fissures go to the height of the tunnel, to the depth of it [a-d] to the width of it. Everything that goes to the height and width of the tunnel as I saw it there, cuts the bedding planes, and in hundreds of places in the tunnel in that way.

At the portal of the tunnel which runs in under the hog's back, by my testimony where I said I found nothing in the tunnel to indicate to me that these fissures or openings extended [*It*] some distance on either side of the tunnel, I do not necessarily mean to be understood as expressing my judgment that the cross fissure, using fissure in the colloquial sense are confined to that hog's back just where the tunnel goes through, because the tunnel leaves the hog's back.

I certainly do mean to give an opinion that the same character of perpendicular fissuring or fissuring dipping slightly from the perpendicular, does not exist all through the upper part of that area of the Snake Creek drainage basin. I do not say in fact that the kind of fissuring we found in the tunnel is confined in my judgment to that Hog's back, it does spread across the canyon and goes into the mountain and elevation on the left. The same character of fissures may extend to the right.

There may be and unquestionably is [*sam*ll] fissures all over the area there, through the earth's crust. Certainly I desire to
405 be understood that the same character of openings which are represented on 139 and on these two companion exhibits, may not be [reasonabl*e*] expected to be found in the hills to the right and to the left as they are to [be*e*] found where the tunnel is and still further to the south, right around the earth.

Mr. MacMillan: We rest.

O. J. CALL, a witness produced by the defendants on surrebuttal, testified in substance as follows:

I am the O. J. Call that testified in the case before and made the [m-asurements] upon Snake Creek and other places in Wasatch County. These measurements were mostly made by float measurement. I made measurements for five or six years. I checked up my float measurements at the weir in the Midway ditch or canal from the river, I did it in this manner: below the weir I made a section of the canal suitable for measuring; and would measure one; I would go over [*their*] by the float measurement, make my computation and then would get the measurement over the weir, read them by the tables and find out whether my work agreed with the

weir measurement; merely as a matter of test. I very seldom was out half a second foot on 8, 10, 15 second feet of water; sometimes one-tenth of a second foot.

I checked up elsewhere. I went over the Provo River system with Mr. Winters, the Telluride engineer; I would take my measurements first, make my computations and then get his and I checked up in that way. He measured the water with a current meter. On a measurement of 60 second feet, about that, we varied one-half second foot; less than a second foot on 60. I do not mean in any one stream. [*It*] measured the Wasatch canal and the north field canal below the point of separation and made my computations. He made them at the point of separation and were within half a second foot in the aggregate of 60 feet. I always used the same degree of care in the making of measurements I testified to in this case as I made at the time I made those comparisons.

In the way of preparing sections for measurements, and to secure accuracy, I would first look over the stream channel to find as suitable place as I could find; having selected what I considered the best place I would then work to secure these conditions I speak of. I have oftentimes put in half a day in preparing suitable sections. I had a shovel and would cut down the banks; also remove
406 the rock if need be, and would take care to get a uniform flow of water so there was no eddies alongside where the water did not flow. Usually if it were possible I secured those conditions. In some streams it was quite easy and in others it was difficult.

I remember the weir in Snake Creek, I observed it. I recall making a current meter measurement of the weir and making a weir depth measurement. I observed the condition of the weir. As I recall it now, the weir was not reliable. Whatever my note was correctly expresses what I found there.

Cross-examination.

By Mr. MacMillan:

This must have been about 1907 or 1908. The weir I have in mind now as a so-called weir, seemed to be leaky. It was made of lumber. I saw it but once. I believe Mr. Springer and I were there together. I went there for the purpose of measuring the water. I took that weir measurement for the purpose of record; record of the county. I took it for the county, as commissioner.

I say I always prepared my streams where I took my measurements with extreme care; cut the banks down; took rocks out of the bottom and cut out any willows, moss or grass. The section I would take would vary according to the streams. I would sometimes take 10, 15, may be up to 30 or 40, as high as 50 feet before I could get a good section.

Suppose I had a 30 foot section, I would clean carefully the section for the full 30 feet and clean out below so I got a free draw, so the water would draw [of-] freely, and also above so when it came it struck that section squarely. I did this whenever I took a float

measurement, always prepared my section first. It made no difference whether it was an irrigating ditch or a mountain stream.

Lavina Creek was very difficult to get a measurement on because it was rocky and quite irregular; I recall working there very hard in water to my waist nearly for several hours, the stream was curving; turning and the bed itself was rocky. I did not get a very smooth bottom before I took my measurement. It was not very satisfactory in that stream on account of the Channel. There were some rocks in the bottom. I could not get the banks straightened up very well and the velocity of the water was very rapid. Mr. Springer was with me on the main channel of Lavina and Snake Creek a time or [t-o]. My notes will show the conditions that existed at the time.

407 Concerning that weir, the note I refer to is found on page 158 of Exhibit 19 and is, "Snake Creek Channel over so-called weir about 300 yards below Mr. Springer's; estimated length of weir 10 feet, depth uniform, 6.5 inches or .542 feet; rate 22 feet per second, cross section 4.42 square feet; flow 11.92 second feet; meter measurement, meter Buff and Buff, no. S. 431. I have now referred to page 52 of Exhibit 16 which was introduced in the former trial of this case. The date of that examination was March 8th, 1908. I turned to page 48 and read, "Commissioner Probst requested me on this date, February 22, 1908, as water commissioner to come to Snake Creek and look over the water of this stream and to get a measurement if possible at the so-called weir put in by the electrical power company. I find conditions such that a measurement with any degree of accuracy is not possible. I gave instructions as to the required conditions for the weir as per instructions from Comissioner Probst." On March 8th I make a measurement over the weir; so I think it must be for the county. The record states I made a measurement and found 11.92 second feet of water. "Revolutions in 15 seconds 28, 35, 37, 37, 36, 38, 31," means that I put the meter in the water on the crest of the weir in various parts of the stream. Those were the revolutions of the meter in that time. The cross section is there given as 5.42, rating 2.5 feet per second. The note I referred to was on February 22nd, 1908. That was a number of days before I went up there to make the measurement shown on page 52. In order to get at those depths I measured from the top of the water down to the board over which the water flowed. After getting the depth I put my current meter down at the place until it struck the blade or board. I never measured water by a current meter at a weir in that manner before nor after, because I think I never had a meter to use. I was not accustomed to the use of a meter. I had assisted some of the Telluride engineers in their measurements and had held the meter for them. I went over the Provo system with one of the engineers and helped him in his work. I got this meter from the Power Company. I had [worded] with it before.

I received my instructions as to how I should determine the flow of water by means of a float from the State Engineer. I followed

those instructions. I used various kinds of floats. First I had a loaded float. When I first became commissioner I was more careful to get things, as I thought, about right, very careful to follow instructions given by the State Engineer, and in the making of a float I had a piece of timber about an inch and a quarter square, the end, and perhaps three or four inches long; at first. I
408 bored a hole in the bottom, in one end of this and loaded it with lead and tested it to see it just buried itself in the water; I used that. Later on I would take a rock and tie it to a piece of stick so it would just bury itself. Later on I discovered something equally good; that was a green willow, certain willow growing along the ditches will just bury itself in the water; so after that I used the willow. I always took the fastest float and would record that in my note book. I would make the computation of the flow of water on the basis of the fastest float. I would get the average cross section of the stream; the number of square feet in the cross section and multiply that by the rate per second, and deducting 20 per cent would give me the cubic feet per second. I deducted the 20 per cent because the State Engineer so instructed me.

You are not to understand that the only test of accuracy of my float measurement was tests or comparisons which I made in connection with Mr. Winters; on large streams *that* were some on small streams. They were in the Kamas section, they were very small, only part of a second foot most of them. I do not recall the exact number; it might have been four or five or six, something like that. I have not testified that my float measurements came within half of a second foot of accuracy, based upon three sets of comparisons only as to one particular instance. I do not want the court to draw the conclusion that my float measurement would be within half a second foot of accuracy on all streams. It is not my opinion that conclusion should be drawn on all streams. On some streams in my opinion a conclusion should be drawn that the measurement arrived at by the float method approaches within one-half second foot of accuracy.

My experience on streams of 8, 10, 12, 15 second feet, and larger that I have referred to, has been that I have come within one-half second foot where I have had suitable places for measurement. I do not know how near I would approach accuracy in some other ditch. In my Kamas test those were off considerable, some 40 and 60 per cent.

I certainly would not say that my tests and comparisons made in the river ditch weir would be a criterion for the court to determine the degree of accuracy which my float measurements may have [attanined] in Lavina Creek or Snake Creek, or streams of that character. I never made a test in a stream like Lavina Creek for the purpose of ascertaining how close I approached accuracy with my float measurement. Conditions in Snake Creek, the main channel, were very much the same as those of the river ditch
409 where I made the measurements. The measurements of the main channel of Snake Creek would not be very far out in my opinion. I would unhesitatingly say within 10 per cent, of

the degree of accuracy I got at the river ditch weir, it may be much less, I do ont know.

I know of necessity that there was a great deal of inaccuracy in making measurements by float, so whenever I could I tested it out. I knew the records of my measurements were going to go into public records. I knew there would be an inaccuracy and I was making these tests for the purpose of determining whether there was an inaccuracy, I was trying to make my record right.

I cannot say whether as the quantity of water increases, it in any way changes my factor of accuracy. When we get in small streams it does. My experience on the Kamas ditches was such it showed me that on small streams that wasn't right, these were below a foot. I do not know where the dividing point is. My notes of the Kamas test are found in my note book marked "Exhibit 16", found on page 40, September 30, 1907; ditch is Kamas in front of John Smith'-. The next experiment found on Page 43 is ditch by Andrew McCammon's.

In my conclusion found on page 156 of Exhibit 19, I state by comparing the above measurements, all on this date, with a 20 per cent reduction from float measurements, taking the fastest float, is not enough for small streams, and in general as the stream decreases in size the amount deducted should increase, the amount deducted from streams flowing between one and two second feet, float measurement, should be from 60 to 40 per cent. That is my judgment; I would rather have judgment than conclusion there. When I say the amount deducted from streams flowing between one and two second feet should be from 60 to 40 per cent deduction I mean from the uncorrected flow; I am not mistaken in that.

Taking my uncorrected flow of the measurement which I have made on the board, which is .814 second feet, I arrive at 55 per cent in this particular case from the corrected flow and 62 per cent from the uncorrected flow. My true measurement as shown by the weirs is 2,945. That was the highest percentage that I found in any of my tests, and I put it down from 60 to 40 per cent.

410 By Mr. MacMillan:

Q. Just step to the Board a minute. Suppose you bought ten head of sheep, after keeping them for a certain time they increased to fourteen head; what would be the percentage of incrase? Figure it out on the Board.

A. 40 per cent.

Q. Figure it out on the Board. I would rather have you make your division. Now you take your 14 and you deduct the original number 10, which gives you an increase of four—a difference of four?

A. Yes.

Q. You divide the difference of four by the original number 10, don't you, which give- you 40 per cent?

A. Yes, sir.

Q. Now, suppose you have 2,945 and you increase to 6,520, what is the percentage of increase? Your original number is 2,945; you

have increased to 6,520, so that your increase is 3,575. Now what is the increase in percentage?

A. 121 per cent.

Q. 121 per cent. Now in the last problem I gave you as the original number of sheep, the same figures which represent the true weir measurement?

A. Yes, sir.

Q. I gave you as the increase the correct float measurements; you find that the difference is 121 per cent, don't you?

A. In the sheep, yes.

Q. Would it be any different whether it is sheep or water?

A. I will say I don't know whether it would If you had that number of feet, no.

Q. Now, Mr. Call, you are satisfied with those figures, aren't you?

A. Yes, the way I have given my testimony I am satisfied with them.

Q. The figures you have last given shows an increase of 121 per cent don't they? Is there anything wrong with those figures?

A. I think so.

Q. Well, what is it?

A. Let's see; I will think it over.

The Court: Mr. Call, you have confused the idea of factor of correction with the error in the percentage.

A. The factor of correction here.

Q. You have been talking about the factor of correction and calling it invariably the percentage of error. Entirely two different questions.

A. The factor of correction is this; error of percentage is this:

Mr. MacMillan: The error of percentage is 55?

411 A. 55.

Q. Isn't the error of percentage 121?

A. Yes, it looks that way; if you take this as the real flow; this is the flow by float.

Q. That doesn't mean anything in the record. State your figures?

A. I wasn't thinking about the record. If .652 is the flow by float, .2945 over the weir, the difference is .3575 and the difference between the actual flow over the weir——

Q. And the corrected flow?

A. And the corrected flow.

Q. By float?

A. By float is 121 per cent of the weir measurement. That is the condition there.

The tests which I made were in September, 1907, and subsequent to that time I made the measurement of the water flowing through Snake Creek, and they were introduced in evidence while I was on the stand at the original trial of this case. On every one of these measurements I simply used 20 per cent as the factor of error.

Redirect examination:

The measurement in front of John Smith's place was in a ditch. The weir measurement was .7923 second feet and the uncorrected float measurement was 1.83 second feet. I should have multiplied by .57 in order to get at the weir measurement in that case, that would be the factor. My corrected measurement was 1.46; substantially 84 per cent too much.

My second point of measurement was by Andrew McCammon's. The weir measurement was .2945. My uncorrected float measurement was .814. The figure I should have multiplied by is 36, which would give the correct weir measurement. That was 121 per cent in excess.

The third place was the same as the second, except there being more water in the ditch and it being measured in a different place. The weir measurement was .7887. My uncorrected float measurement 1.35 second feet. In order to get at the correct flow I should have multiplied in that case by .58, I was in error 37 per cent.

When I was with the gentlemen from the Telluride Power Company up at Wasatch I measured two streams during the day; which totaled 60 feet. I measured them independent of him and then compared notes. My measurement was 61.92 second feet and his was 62.5 second feet. I had .58 of a second foot less than he and was about nine-tenths of one per cent in error; too low. We
412 frequently compared our float measurements at the Midway weir river ditch with the weir measurements. My remembrance is that my error did not exceed one half cubic foot per second. It was so close I was satisfied I was doing relatively satisfactory work. If there was ten cubic feet per second flowing and my error was one-half of one cubic foot in excess, I would be in error five per cent in excess.

In my judgment no one could make a comparison between my determinations on those Kamas streams of less than one second foot that would be valuable in determining comparisons made in such streams as the Provo river with six to ten second feet, because the conditions were different and the error absolutely different.

I made, as shown by my records, a number of measurements in different years of the total flow of Snake Creek. The total quantity in the irrigation ditches and the main creek. The point of measurement of Snake Creek channel proper was about a mile and half north of Midway and west; down beyond the [month] of the canyon on comparatively flat ground.

As I stated this morning, the channel where I measured Snake Creek was comparable in my judgment with the river ditch that I have referred to. I made all of these other measurements which go to make up Snake Creek in artificial ditch channel, as far as the character of bank and bottom and so forth is concerned, they were very the same. Where the amount of water was similar or like amount, they should compare very favorably, very much the same in accuracy with my measurements of the river ditch.

In my judgment my measurements at Kamas would be no guide to anybody in considering the accuracy of my measurements of

Snake Creek made in these artificial channels. The streams were larger and the channels deeper. Most of them, if not all, were smooth artificial channels; some of them [*ahd*] been silted in. These were the streams I said I put in as good conditions as I could. I spent whatever time was necessary on them to do that.

In my judgment in these measurements of the total flow of Snake Creek that I have spoken of, that were made in these artificial channels and in Snake Creek proper where I have described it,
413 10 per cent of error would certainly cover the error and it might be less.

Referring again to the weir about 300 yards south of Springer's in my notes of March, 1908. The record shows the depth of water flowing over the crest of the weir as an average of 5.5 inches. There was a difference in the depth flowing over the crest of the weir, I have 5, 6, 6, 5.5 and 5. There was a difference of an inch in the depth of the water.

In the measurements that were detailed where I took the total flow of Snake Creek, they were all made in artificial channels, except one in the main channel of Snake Creek, just outside of the town of Midway and below the mouth of the canyon.

John J. Burgner, a witness produced by the defendants on surrebuttal, testified in substance as follows:

I live at Midway. I knew the weir in Snake Creek in 1907 and 1908. I would judge it was about 300 yards below Captain Springer's house. I built it under the direction of Mr. J. R. Murdock. He employed me to build it; told me where to build it and what to do.

The bed of the stream where we put this weir was in gravel, all kinds, large and small; the larger as big as your [*first*] or bigger. That gravel extended above and below the weir for several feet at least. The so-called weir was made out of a couple of cottonwood logs, and two plank; that was the dam in the front. We put these two cottonwood logs on top of one another; then these two plank we put on the back up stream, that is across the stream on the upper side of the logs, and then we put in the brush and old rotten straw and material that was made out of gravel and dirt. Nothing was put on top of the planks, this was in November, 1907. When we got through it was in tight; water flowed around it and under it, I would say one-third went under and around it. I saw it again about a month after, there was a break and we went and replaced it. There was nothing put on top of those two plank at that time. I think the plank were 12 inches; one of them had a bevel cut in the top. Instead of having the sharp edge of the bevel up-stream we had it down stream. I think the opening on top of the plank was five or six inches deep, when we went back there we done nothing except fill the opening where the water had passed [through*t*], we chincked that in and blocked it up. It was not tight on that
414 opening; it went out afterwards. I never saw it after that.

Cross-examination:

The last time I saw that weir was in December, 1907. I neve thought about it again until June when Mr. Buehler came to me an a-ked me if I built that weir and I said yes and he said I was wante here to testify. Then I spent about fifteen minutes talking with Mr Ernest Probst, who helped me [built] it, and that is all I hav thought or talked about it since 1907.

We did our best to make all of the water flow over the blade o the weir, but nothwithstanding all we could do, one-third of it flowe through the weir and other places.

I could not say exactly how wide the opening was across th stream; I believe it was between 9 and 10 feet. The fall, from th blade down to the bed of the stream on the lower side was about 1 inches. There was a lot of water in the stream and it was going ove the blade slowly. I could see the water leaking at places on the weir It cut through on the right side so the water went through an they sent for me to fix it. We fixed it with sacks and gravel; pu sacks in on the up-side, then we covered that up with gravel. Whe we got through there was some water going through yet, I woul say one-fourth of the full flow of the stream.

The drawing on a piece of paper here shown me is a correct cop of what is on the black board.

Mr. MacMillan: We offer it in evidence.

The Witness: I could not tell you how high up and down th opening was at point 9 through which the water was escapin extending for one foot into the stream. It had dug its way unde the log. There is quite a hole there; one foot wide and two or thre feet deep cut into the bed of the stream.

Q. I asked you if you talked to anybody else; you said no, didn' you?

A. I sure did.

Q. You knew you had talked to General Wedgwood didn't you

A. That didn't come to me at the time.

Q. You knew you had talked to General Wedgwood didn't you

A. I did.

Q. So you answered me falsely didn't you?

A. I did right there, sure.

415 Redirect examination:

Q. Did you have any intention of deceiving the gentlemen?

A. Not a bit; if he had asked me that question I would have tol him.

Ernest Probst, a witness produced by the defendant on sur-rebuttal, testified in substance as follows:

I live at Midway. I am a property owner there. I went u Snake Creek with Mr. Burgner in the latter part of November, 1907. Mr. Murdock sent us up and instructed us to put in a weir. In my

judgment the weir was constructed about 300 yards below Mr. Springer's place.

We had no material there, only what we could gather on the creek bed. We cut two cottonwood logs between 12 and 14 inches through and put one in the bottom of the bed of the creek; the other one on top, and the two plank in front of the logs and then put in brush, then straw, then gravel. Mr. Murdock furnished the plank and we took them up with us.

I have heard Mr. Burgner describe the weir and [*an*] copy has been introduced in evidence as Exhibit 194. That describes the two boards we placed on the logs. The bevel was up-stream as testified to by Mr. Burgner. After we constructed it it did not completely shut off the water; it leaked some. I would judge between a fourth and a third escaped.

We returned to the weir at the time of the break, probably a month later in December. [Th-re] wa sa break, in the side at the end of the logs in the plank we had put in broke into the bank and came out the side of the bank. We put in cinders, brush and gravel and tried to stop it the best we could. After we reconstructed it, it is my judgment that it leaked about the same as it did when we first constructed it.

Cross-examination:

After we first constructed the weir water leaked out of it in the bottom and in the side from 9 clear across to 19. I could see it leak under the bottom of the logs. It was also leaking on both sides between 8 and 9 and between 7 and 10 and between 8 and 10, it was leaking between the joints where the two planks came together.

From line 3 to 4 down to the bottom of the ditch it is between 18 and 19 inches. Between point 4 and 5 over the blade the
416 water from four to five inches deep. We had four to five inches of water falling over this blade and it dropped 18 inches. You could look under that water and see the leak between points 11 and 12, by looking under the edge, the water fell out far enough so you could see [thr*i*ugh]. From 3 to 4 I would judge was five or six feet.

The part cut out of the upper plank, the mouth that was made for the water to flow through, is five or six feet wide. We could see clear through that five or six feet that water was leaking out in the crack which was formed by two planks.

I went up there with Mr. Burgner in December to make those repairs which Mr. Murdock requested. When we went up there was quite a stream coming out of that hole. We sealed up that hole the best we could. After we got through there was about one-fourth or one-third of the stream flowing through there besides what seeped through under the bed. I could not tell you how much seeped through, it was leaking. After we sealed up the break more water came over the blade than there was when we found the [*w*hole].

I have a farm there. I get my water from the Midway Irrigation Company. Mr. Burgner owns water from the company.

WILFRED VAN WAGENEN, a witness produced by the defendants in the former trial of this case and whose testimony was read into the record of this trial, testified in substance as follows:

Something was said in the testimony of plaintiff about a dam used by Mr. Brooks in making measurements in 1900. Sometime in the early part of September, 1900 there was a dam constructed there. I made it. It was just a couple of poles cut and thrown across the stream and some rocks and gravel thrown in. It did not stop all the water except what flowed over it. There was no measurement made. He just made an estimate of the water flowing there and through the dam. He did not put a rule on it. There was not what you would call a weir there. Possibly one-half of the water flowed over the poles and about one-half of it went through beneath the poles and through the rocks.

I say I made what there was there in the nature of a dam. Mr. Murdock and Mr. Burgner were there. I was about an
417 hour and a half or two hours in making it. There was nothing there to start with, no commencement of the dam before that. There was no other dam in that place excepting the one we constructed nor any weirs near that point. There was no dam constructed there in 1898 or 1899. There never was a dam put there or near that point except the one I made.

I told Mr. Brooks no man on earth could measure the water in that kind of a place and get an accurate measurement and he said he only wanted an estimate. Mr. Murdock and Mr. Brooks were not there when I was making this dam. They had some work that had been done on the hill and I think they were up there.

During 1914 I was president of the company and one of the witnesses testified that I [*u*nstructed] him to turn some water off that had been turned down to the company, I remember the occasion, the water was turned off after that, I do not know on just what date. At our last point of diversion I ordered our water master to turn down one-half second foot. Not any was sent down from the river. It did not run any length of time.

In 1914 there was an additional supply of water over and above our normal supply of nine second feet from the river. With that additional supply we had as much [*was*] as we had been accustomed to having in normal year.

Cross-examination:

I was elected President the last time in January 1915. It makes some difference to me who wins this suit. I have a financial interest. I also have an interest arising from the fact that I and the board of directors of this irrigation company in 1913 had a [differe*d*] with reference to the water. In 1913 some of the board of directors conceded eleven second feet of these waters and a controversy arose between myself and some of the board of directors, we have had contentions over the matter and as a result an election was held and I was made president of the company. I naturally desired to vindicate my position.

I put the dam in in September, 1900. I put a couple of poles across the stream and filled it with rock and some little gravel. I knew that Mr. Brooks testified to this same thing in the Mountain Lake Tunnel case. I happened to be there because I was interested with Mr. Murdock; we had located that as a power site in
418 1898 and had some little work done on it, cutting brush, etc.
I do not know whether Mr. Brooks was there in 1899, I did not see him.

I know the facts I am [testif-ing] to [occureed] in 1900. We had done a little work [done] upon a trench in 1899 and cut a little brush.

I know I was there the particular day that Mr. Brooks was there. I do not know whether he was there before or afterwards. I would say Mr. Murdock did not have planks taken up there for the purpose of making a weir crest. I will say he did not do it. I will say he did not have men working on that dam in order to stop the water, I can say this because I was up and down the creek a number of times before this date mentioned. I do not know how many days Mr. Brooks was there. I was there this particular day when he talked about measurements. I did not see him level the crest of the weir. I did not see him put in the gauge over the weir.

After I became president in 1914 I became very zealous in carrying out my policy with reference to the distribution of water. There was a water [commission-] over that district in 1914, he ordered water to be turned down to the Provo Reservoir Company on account of the tunnel water. I promised it would be turned down. I turned down one-half second foot; that was in accordance with the order. He did not order two second feet turned down. I think the following day I shut a small amount of water off, I ordered it shut off.

Redirect examination:

I saw this same dam after the day I made it and the day on which Mr. Brooks made an estimate. I never saw any boards there or any weir for measuring water. I saw it perhaps a month afterwards, the water was then running at the dam practically the same as when I put it in.

Edward Bagley, a witness produced by the defendants in sur-rebuttal at the former trial and whose testimony was read into the records of this trial, testified in substance as follows:

I know Mr. Van Wagenen and Mr. Murdock. I worked for them in connection with some power plant scheme in 1900 in the latter part of May. The last work was closed sometime in August.
419 I saw the creek while I was there. Our camp was on the west side of the creek about 100 yards away. I did not see any dam in that creek during the summer months when I was there. There was no dam anywhere from 100 to 250 or 300 feet below the junction of Snake Creek and Lavina Creek.

Cross-examination:

I am a farmer and laboring man. Mr. Murdock hired me up there on Snake Creek in 1900. He was the only man who hired me and I was under the impression that Wilford Van Wagenen was in company with him.

What I was doing upon Snake Creek in 1900 was cutting brush and building a trail around the mountain for a right of way to build a flume for a power plant. We were digging out a trench or trail there, it was some distance below the junction of Snake Creek and Lavina Creek.

ERNEST KOEHLER, a witness produced by the defendants at the former trial and whose testimony was read into the history of this trial, testified in substance as follows:

In the year 1898, 1899 and 1900 I was familiar with the channel of Snake Creek for 300 or 400 feet below the junction of Snake Creek and Lavina Creek. I became familiar with it working in the Mountain Lake tunnel, going up and down the canyon. I had that employment for four seasons. There was no dam within 200 or 300 feet below the point where Snake Creek and Lavina Creek come together in the years 1898 and 1899.

Cross-examination:

I remember that very distinctly. The question as to whether there was a dam there in 1900 was brought to my attention two years after. A man by the name of Buehler located that power site and this Mr. Buehler and myself were employed by him to go and work on that site; that was in 1902. It was regarded then that there had been a dam put in before and we were asked at that time whether we had seen a dam in there.

WILFORD VAN WAGENEN, a witness produced by the defendant on sur-rebuttal, testified in substance as follows:

I am acquainted with the reasonable market value of land or the actual cash value of land embraced within the Midway Irrigation Company served by Snake Creek.
420 The reasonable market value of lands served by Snake Creek with homes thereon is about $125.00 to $150.00 per acre which includes water rights. I have testified before that substantially 3,500 acres are served by Snake Creek. There is no swampy land embraced within the 3,500 acres of ground served by Snake Creek. There is a little swampy land west of Snake Creek where there is a spring, that is not included in the Midway Irrigation Company but is indicated by two red enclosures on Professor Ledyard's plat. Southeast of Midway there is a trout pond, that is not part of the Midway Irrigation Company which is marked on Professor Ledyard's plat "Trout".

On May 22nd, I was with Mr. Wentz and Mr. Tanner at that trout spring. We examined the lands between there and Midway

and through Midway. We walked down throught Midway and the fields right in line with the trout spring, that would cross the area marked within the red lines as "swamp". We especially examined that piece of ground down through there, there was no swamp there. It is what we call the potrock ground, grain and alfalfa is raised on it. Going beyond Midway north and a little west, Professor Ledyard has another area in red. There is some swampy ground up there, that was a lake at one time, it has been practically drained. There is a large spring there, no part of that land is included within the Midway Irrigation Company.

It has been said by Mr. Ledyard, who testified with regard to Exhibit 125, that part of the alfalfa was a poor stand. We have had a weevil trouble there about seven or eight years. We seed with other grasses usually whenever the alfalfa is affected. There is much less alfalfa now, in acreage, than there was before the weevil struck it. It has been broke up a good deal of it and put to timothy, clover and grain.

Cross-examination:

By swampy ground I mean ground that does not require irrigation. We grow timothy all over the whole system.

With reference to Midway, the system extends to about a mile south and north two miles up Snake Creek canyon, possibly a mile east of Midway and about three quarters of a mile west.

I recognize Exhibit 126 as a picture of something; I could not tell you as to a lucern field, I never saw a lucern field up there
421 look like that, it may have looked that way in the early part of the season, the lucern starting first; later on the other covers the lucern. I never remember of seeing any fields up there where lucern was so scattered, it is an exceptional field.

Perennial plants that grow in swampy ground are what we call flags, wire grass and broadleaf. We have none anywheres near where we are irrigating. Most all of the land of the Midway Irrigation Company is bench land; it is not flat, bottom ground. There is not very much meadow land on each side of Snake Creek where it runs through the district, it is all cultivated, there is very little but what is cultivated ground.

I say there are 3,500 acres of land served by Snake Creek, and about 500 acres by the river ditch, there would be possibly in the neighborhood of 4,000 acres, may be not quite 3,500 of the land is served by Snake Creek, possibly 3,200 or 3,300 acres.

In the low water period we get 8 second feet of water from the upper river ditch, 5.50 second feet of that is Ontario tunnel water.

There is another river ditch we call the "Island ditch". I think we irrigated 250 acres from that ditch.

Redirect examination:

We could not raise timothy or any agricultural crop there without irrigation.

Caleb Tanner, recalled by the defendants on sur-rebuttal testified in substance as follows:

On or about the 22nd or 23rd day of May I was in company with Mr. Wentz, Mr. Van Wagenen and Mr. Alder. We went over the land lying to some extent south and north of Midway. We went to a place where there had once been a trout pond, it was south of Midway.

Referring to Mr. Ledyard's Exhibit 125 which he says is not drawn to scale, the black pencil cross marked "Trout" would be something near where the old trout pond was. We looked over the lands from that trout pond to the north and west of Midway a mile or two and examined them, the character of the lands lying between the trout stream and the north part of Midway are potrock lands, they are not swampy lands. Forage crops and some grain
422 was growing upon those lands. We went north and a little
west of Midway in the locality of the red enclosures, these were all dry lands. There is a big spring up there, somewhat to the west of the center of town, and around that spring there was quite a large area of waste land, it would appear to be approximately the area within the red pencil. The spring I have in mind is about one mile east of Schneider's Hotel.

Referring to plat 125 again, there are two little oval spaces marked, between Schneider's Hotel and Midway, one on each side of Snake Creek, there are a couple of little pieces of ground in there that are wet, adjacent to another spring. Down below, which Mr. Van Wagenen testifies is not within the Midway system, there is another spring that is south under the hill. There is some wet land there.

There is no conflict between the paragraph that has been read from Le Conte and the paragraph read from Water Supply Paper 219 by W. C. Mendenhall with reference to the disposition of flow of sub-surface waters. The text in Le Conte's work on geology is a general statement of the matters covering rainfall and its runoff as surface flow and as a subterranean flow; this being on page 74, and referring to page 10 of the same work. In the general statement there are three divisions; that it rushes off immediately from the surface, causes the floods of the rivers, especially the smaller streams; second, that it sinks into the earth and after doing its chemical work of soil making, re-appears as springs and forms the regular supply of streams and rivers; third, that it reaches the sea wholly by subterranean channels. Of these the first two of the erosive agents, and these only concern us at present; of these the former predominate in proportion as the land surface is bare, the latter in proportion as it is covered by vegetation. "As we have already seen," page 10 which I have read, "of the rain which falls on any drainage basin, a part runs from the surface producing universal erosion; a second part sinks into the earth and after a longer or shorter subterranean course comes up as springs and unites with the surface water to form rivers, while a third portion never comes up at all but continues by subterranean passages to the sea." Then

there is a star and a foot note: "A fourth part escapes by evaporation. In arid regions this is the major part of the total rainfall", this last portion, that is the portion that continues by subterranean passages to the sea, is removed from observation and our knowledge concerning it is very limited, but there are numerous facts which leads to the conviction that it is often very considerable in
423 amount. In many portions of the sea near shore, springs and even large rivers of fresh water are known to well up". Then specific examples are given, the Mediterranean on our own eastern coast, in the West Indian Isles and at other points.

As a general statement that is true. There are in every subject of this kind detailed investigations or detailed statements which subdivide the subject matter more intimately than is done in general texts as that written by Mendenhall for the foothills belt of Southern California where the statement occurs on page 23 that "underground waters are just as dependent as the surface run-off on precipitation within the local contributing drainage basin, but the tenacity of the oft-asserted belief that these subterranean reservoirs have some other source than local rainfall makes it desirable to repeat this statement with emphasis."

The subject matter of seepage waters as stated in general by Le Conte is by the detailed investigators divided into two great subdivisions of investigation; one is called the upper zone of flow, and the other is called the deeper zone of flow. The upper zone of flow is bounded in its upper surface by the water plane and on its lower surface by an impervious layer; the deeper zones of flow are bounded on both of their upper and lower surfaces by impervious layers. To the first set of phenomena most of the underground water conditions fall for it is only under very special geological conditions that the second set of the phenomena occur. And even in area where this occurrence is, speaking generally, even there the outflow in the deep zones of flow are controlled and are in the direction of the larger topographic features, and they are the controlling boundaries of the drainage area, so that in my view there is no discrimination between the statement in Le Conte which is a general statement covering a great range of phenomena, and the more specific statement of Mendenhall which goes more intimately into the subject matter.

Q. Just one question in relation to that: are there occasions, that is, localities where the sea or bodies of standing waters like lakes, are in fact the discharge area of the drainage basin?

A. That is very commonly the case along the sea coast area, all along the eastern border of the United States from what is described in the books as the Piedmont Belt, being the granitic backbone that extends that Pennsylvania well into northern Alabama, there
424 has drifted off in the ages to the east the standstones or sand clays that make up later formations. These formations dip towards the east. They outcrop near the mountains and where porous gather the rainfall that comes upon their surface, and where they are crossed by streams there flows into the interstices of this porous material part of the stream flow. These layers extend down

to the sea; in places great springs where they outcrop break from the outer margins of these layers. Sometimes they outcrop on the land at a lower elevation than their intake and form great springs, such as the Suanee Springs of Northern Florida. The springs in the sea itself and in the land lying eastward of the sea, where these layers have been brought to the surface by erosion, are the outflow in a normal way in accordance with the general topographic condition of these subterranean waters that have been described as moving in the zone of deeper flow—of deep flow.

Q. Taking Utah Lake, what is the fact as to whether or not Utah Lake is within the discharge area of its own drainage basis where springs such as you have illustrated——

A. Yes.

Q. —May exist there?

A. Yes.

Q. And the mountain right down to the shore of the lake in places?

A. Yes.

The Witness: Referring now to Exhibit 144 and what Mr. Friendly referred to as a "knob" commencing somewhere along the first of April and going through June of 1917, and referring also to May, 1918, in relation to which he said that a similar knob appeared to be forming for 1918 as to 1917 and that in his judgment the raise in the flow of water at that time indicated by the -nob was due to heavy run-off into the tunnel from surface precipitation, we assume that knob is caused by heavy run-off from surface precipitation I think it indicates something in regard to the relation of the flow of water from the tunnel and surface precipitation.

The knob produced during the month of April until June being in harmony in that period of time with the snow melting period in the average elevation of the Snake Creek basin above the tunnel portal would indicate that a considerable surface was responding to run-off into the rocks and into the tunnel which before that time and subsequent to that time were not contributing areas. If that be the case then, the higher portions of the drainage area and the remoter portions of the drainage area lying above the portal of the tunnel would because of their later melting and because of
425 their longer distance come to the tunnel at later times, and make their contributions over a relatively longer period and with greater uniformity than the small area relatively that contributed the earlier melting that produced the knob. Speaking in a general way, the hydrograph of the Mountain Lake tunnel, the [hydr*p*graph] of Snake Creek and Lavina Creek, 141 and 142 show the same characteristics; they have a wide range of flow and the distance between the maximum and minimum is very great. In these respects they both are in characteristics like the hydrograph of surface streams of this country. The peak in the hydrograph of the Mountain Lake tunnel is somewhat delayed compared with the hydrograph of Snake Creek and Lavina Creek. This difference might be described to elevation, as a general proposition the higher in altitude a stream is gauged, the later in the season its peak curves.

From these hydrographs and in my opinion, I should say that the Mountain Lake tunnel is as dependent upon yearly surface precipitation as the natural streams of the Snake Creek area are. The hydrographs show that the very high and lower peaks are accordant measurably, that the fluctuations are synchronous, Snake Creek and Lavina Creek unquestionably being due to surface supplies, and the fluctuations of the hydrograph in the Mountain Lake tunnel must be due to the same cause and therefore dependent upon the surface precipitation.

I know Snake Creek and have been at the Mountain Lake tunnel. I know that all of the water from this tunnel flows into Snake Creek and down to the point of measurement stated for hydrograph 141 as given by the evidence, opposite the tunnel. If we assume that the decree in the Mountain Lake case against Midway in fixing the flow of the springs that are now issuing from the Mountain Lake tunnel, at 3.50 cubic feet per second, as was stated in the findings read the other day, there is no more water in Snake Creek at that point of measurement than the volume of those springs would have discharged, absolutely independent of the tunnel. I mean at the low points. So then, assuming that the flow of the springs was as found, 3.50 second feet, the Mountain Lake tunnel has added nothing whatever to the flow of Snake Creek, and this is a demonstration as to that tunnel flow—assuming the water was struck which dried up the springs in 1902—after 16 years.

Referring to hydrograph 144, about April, 1911, a discharge is shown of 5.50 cubic feet per second which took place when a fissure was cut, as testified to by Mr. Friendly. That relatively great
426 discharge for the period immediately following the cutting
of the fissure, which fell off rapidly in relatively a short time to approximately one-half the volume, would indicate that a zone of water having a relatively easy outlet into the tunnel was cut; that the static pressure was very much reduced, and the flow in accordance with the reduction of pressure fell off until it reached a stage that permitted a contribution to the tunnel of approximately one-half the maximum volume. Any outlet through the rock naturally into some avenue of outflow under the original static head, would be diminished in the quantity of that outflow because of the reduction in this exhausted zone due to the presence of the tunnel there and cutting into it. Some of those flows situated so that their outflow depended upon a static head that laid between the original static head would be dried up. The fact shown by that hydrograph is a demonstration that not only water was there in that fissure, but that also there — a source of supply of water for it.

Almost invariably where there is a fissure and a continuing source of supply in a state of nature there would be a discharge. If there was no opening in the rocks from that fissure except its inflow, it would fill up to the points of inflow and after that the water instead of going down into the zone or fissure would flow off on bedrock.

About September 1st, or the middle of August the tunnel again raises in its discharge flow to five cubic feet per second and from March 1912 until July 1912, there were several variations up and

down, and from that point until October, 1912, there were several variations, and at that time the tunnel reached a flow of about 17 second feet and then subsided again in the latter part of the year 1913, went up again, down and up continuously until the work of the tunnel ceased along in April 1916; what I have said in regard to the first flow struck, the lowering of the water level or static head, applies to all these other different indications and phenomena similar to its throughout the tunnel; the same explanations, the same demonstration and the same theories follow.

The tunnel is shown in 1917, a year after work ceased within it, to have become reduced to a flow of 15 second feet or thereabouts, and in the year 1918 in May, to substantially 14 second feet, as shown by the hydrograph. There is no way a person can tell whether or not the history of this tunnel will be the same as that of the Mountain Lake tunnel, as we have found it from the hydrograph, or whether the flow of 13 or 14 second feet will keep up for 16 or 18 years. There is no knowledge in regard to that
427 except a general forecast. Other things being equal, the
deeper the zone from which the orifice draws, the more regular is the outflow, less the variation from point to point in the year. This tunnel is an artificial drainage depression, and the master one at that, and being within the drainage area carries water in abundance and the probabilites are that it would continue to flow a [a] substantial quantity of water in the years to come; but what relation to its present volume that would be is undetermined, except in a very general way.

Assuming the elevations of the tunnels and workings on Exhibits 173 and 187 to be correct and also assuming that along the divide easterly and westerly crossing it was the center of a great movement, creating great fissures or master fissures in the Park City district and extending over on to the State Creek side, and in driving the Snake Creek tunnel there was developed very many fissures or openings of various widths as indicated on Exhibit 139, crossing the tunnel and through which water flowed into the tunnel, and that in connection with that great movement which caused fissuring and displacement of the formations, the country became broken and crushed in the Snake Creek district, and assuming that conditions exist on the Park City side of the divide substantially as testified to by Mr. Friendly, that is, that ground water is found in great abundance, that it comes within a short distance of the surface, that its horizon as to the surface is shown upon Exhibit 173 in relation to the diorite mass of Clayton Peak, and that Exhibit 187 as shown upon 173, as marked, some 1,600 feet in the diorite to the south as shown by Exhibit 144, and indicated by 173, and also that it is substantially impossible for any great quantity of ground water to escape upon the Park City side, either through tunnels or natural master drainage depressions, but that it lies there, and also taking into consideration the elevation and slope of the Park City side, and if you further assume as one of the primary elements that the areas on both sides of the divide between Snake Creek tunnel and the Park City area are broken, crushed, fractured and fissured, we have under these circumstances

the normal ground water phenomena to which I made reference in the beginning of my testimony today; that is the upper boundary of the ground water in this case is the ground water surface and not an impervious layer, so that the movement of ground water in this area belongs to the subdivision of the surface zone of ground water.

In the surface zone of ground water the water moves accordant
428 with the ground water slopes and at a rate dependent upon the openings through which it moves. Assuming that the ground water divide accords, as is shown by 187 and 173, with the topographic divides, the ground water in the Snake Creek area will move from the Park City Snake Creek divides toward the north from the Park City Snake Creek divides southward in to the Snake Creek drainage area very slowly through the fine grained materials encountered along its course, with comparative rapidity in the coarser grained material or through the relatively open ways that under some circumstances would be furnished by the fractures themselves if they were of considerable magnitude. No outflow can occur against the slope of the ground water unless it occurs through an avenue that is definitely circumscribed and impermeable through all the distance that the water moves in such avenue against or in an opposite direction from the slope of the ground water surface. Assuming that this area on both sides of the divide is fissured, fractured, crushed and broken, there cannot exist any avenue of outflow against the slope of the ground water, without it having been inevitably broken across by the fissures, crushed or invaded so as to permit the influence of the ground water to thoroughly and completely ramify throughout all the depths and in all the surface of these areas, and therefore the outflows from it cannot occur in any other direction except as the ground water slopes, and the ground water slopes in general in the same direction as the surface slopes. The ground water slopes towards the north from the divides as is shown in Exhibit 187, in general accordant with the surface slope. Assuming that same condition to obtain to the south of the divide, the flow of the ground water from the divide towards the south, other things being equal, will be greater than the flow in any other direction, since that is the direction of maximum slope, and here the water will run in greatest quantities and with the greater speed, other things being equal.

If the movement which has been testified to along the axis as testified to and the crushing *to* occurred, as also testified to and illustrated on the exhibits there would be many openings in the rocks capable of discharging water on the Snake Creek side.

In my judgment, before the building of the Snake Creek tunnel those fissu-es and openings in the rock I have just referred to on the Snake Creek side must have been discharging water lying as ground water in the diorite and the lime into that basin.

429 Cross-examination:

In regard to the hump in May and June, 1917, I meant to say that prior to May, or in March, that the snow was not melted above there

at that time and later it did melt and run into the tunnel and caused this hump. The hump needs an explanation apart from the other mass of water and that is the way I explain it.

In regard to my answer as to the flow of water indicated on Exhibit 144 just prior to May, 1911, giving 5.50 second feet and the sudden drop off within a very short time to three second feet—if you look upon the rock that was traversed by the tunnel in driving into it as the dam, it would indicate that before the tunnel cut in there, there was an underground dam that was backing up the water at that point and I explained the other high peaks on Exhibit 144 in a similar way and I stated that if there was a constant supply to the underground sources and it was being dammed up, as these may have been dammed up, as shown on Exhibit 144, there would be an outflow sometime at some point to meet the constant inflow. I, or no other geologist, could point to the exact spot where that outflow might be; I have no direct evidence of the particular spot.

It is possible you may have a reservoir which on three sides, because of the impervious material, will let no water go out, whereas on the other side the water will flow out. Other things being equal, you may have a reservoir where you have on two opposite sides material of different kinds, that is interstices larger on one side than on the other, orifices or cracks or fissures or broken country, whatever you care to call it, and you will get more of the outflow where they have the larger openings than you will where you have the smaller openings. My hypothesis, in my testimony, referring to the point where the water line, Exhibit 144, first started, wasn't a dam there. I said the layers as you went through might be looked upon, wherever you invaded a zone of storage as a dam and that water gathered there under ground it forms a reservoir until it finds a point of outlet. It may find the outlet to the right or to the left or to the back, dependent upon conditions underground. When you come along and tap that dam then there occurs what I referred to in my original evidence as a balancing of conditions underground, with reference to the new outlet; and when you get into an outlet there is a sudden flow such as there is there and then the outflow drops down. The same thing would occur in the Mountain Lake tunnel when
430 they were driving that tunnel, there would be, at times, a large portion of water and when they stopped driving there would be a balancing condition.

You did not understand me to say in my direct evidence that if the facts are as shown on Exhibit 187 that I drew the conclusion that water from the Park City side must then necessarily flow through the divide into the Snake Creek side. I would not say that; I am not right positive where the water divide is, but wherever you find a water parting, and somewhere under the crest of that mountain or a little to one side or the other is a water parting where the ground water slopes to the north and to the south, so that under those circumstances, in my judgment, with the advantages of sloping towards the south, the underground water divide would be somewhat to the north, but I think as a general proposition that the water parting very closely approximates the topographic parting. If you have a

contour of a surface similar to the one we have drawn on the board, let the broken line up from the peak represent the divide, all other things being equal, the greater flow of water would be to the left because of the greater fall of the contour of the country. The advantage of the gradient in that direction would make for the greater flow in that direction.

Frequently we have places underground which may be measurably looked upon as natural reservoirs, because they are favorable to the gathering of waters, and water gathers into them from all sides until it gets filled with water to the point of overflowing and then it finds some way of outlet.

Referring to Exhibit 168. I know that from Clayton Peak the ground slopes to the north and to the east, to the south and to the west and taking nothing but the gradient you will have water flowing in all parts of the scountry; not only south in the Snake Creek district, but off into the Cottonwoods and into the American Fork district and the Weber drainage district. I have made no investiagtions to determine what proportion flows into those other directions except that the divide of the ground water would be determinative of that; all I have answered that question in reference to is on the assumption that the ground water is accordant with the topographic surface and with the topographic divide.

If we assume conditions are as shown on Exhibit 187 and also assume the diorite as shown on Exhibit 173 formed a favorable receptacle for water and for storing it and the greater flow of the
431 water followed the greater gradient which would be to the
Snake Creek side as compared to the Park City side, with this great quantity of water underground indicated by Exhibit 187, by the water that is flowing out of the Park City underground works, if what I say is true, I would not expect to find now in the Snake Creek side great springs of water delivering great quantities of water. The movement of the upper ground water in the soil and rocks from drainage areas, occurs as an imperceptible seepage inflow into the stream and the smaller tributaries without reaching down to the main drainage channel of the area, occasionally the outflow is concentrated and the phenomena of a spring of importance occurs, but the imperceptible seepage is the main thing as indicated by the investigations of men, by the books and by my own observation. That would be the seepage that was gathered into the tributaries through the rivers.

Assuming that from the side of least gradient we have the broken up territory with large fissures running through it, that on the other side we have only small fissures, none that are at all comparable to the fissures which appear *of* the side of the least gradient, all other things being equal you would expect the greater flow of water from the reservoir to go out on the side where the big fissures and broken up territory is.

Assuming that on the side of the greatest gradient we have an underground dam and circumscribing this reservoir, a dike we will say, when the water does come from this reservoir on to the side of the greatest gradient it meets this underground dam, the tendency

of that dam would be to force the water back into the reservoir and in a measure cause a pressure on the side of least resistance. If on the side of least gradient the beds dip away from the reservoir, that would be an additional factor to leading the water from that reservoir in that direction, if the beds were porous. All other things being equal and all other conditions remaining constant as they were before, if the dip of the strata was towards the reservoir on the side of the greatest gradient that would be another factor. Assuming that you tap a country of this kind with a tunnel and you strike your underground dam, when you get through it you get a peak flow on the hydrograph which immediately falls away exactly as the first peak flow as shown on Exhibit 144. If you go a little further and assuming you have another underground dam, when you get through that you would get a peak flow and as you go up and pass into the reservoir, all other conditions being equal, the flow of water out of the tunnel would be steadier and would increase. In other
words, on the assumption taken, you would have high peaks
432 before you strike the underground reservoir which would not
be so noticeable after you struck it.

Assuming that we go in on the other side with a tunnel—as we strike the great master fissures which traverse the country, the water which came from the underground reservoir and sought its way through these master fissures would empty into the tunnel and the more of those you strike and the further you may get with [those] towards your underground reservoir, the more water you would get.

If you run a tunnel on each side and intersected a number of these fissures before you get to the diorite on the line of least gradient would be greater than if the tapping had been done at the same elevation from the side of greatest gradient and I think the converse of that would be true if you tapped it from the side of greater gradient, except there is this modifying influence; assuming that the sources of supply were sufficient in both instances just to keep the reservoir full to the surface of the territory, as represented on Exhibit 187.

When you have an underground reservoir such as has been represented on the board and to which reference has been made in questions to me, it is not exactly like having an open reservoir such as you would find on the surface, because the water is confined in small fractures or fissures which it occupies. If you have this reservoir with a series of fractures and fissures criscrossing in the manner shown upon the board and it is tapped at the bottom as the water comes down it is guided in its direction by these fractures running in different directions.

When you have an underground reservoir such as has been represented on the board and described in questions, you have the water confined in small spaces in a large territory with considerable pressure, and any relief of that pressure will cause a draining of the opening in which the water is found.

Q. Now, Mr. Tanner, if we assume that the representation which has been made on the board truly represents an underground area

occupied by diorite, such as has been described by Mr. Friendly and Mr. McKay, which would afford a natural underground reservoir, that the divide on the surface is up above and practically in the center of this diorite area, that the surface falls away to the north and to the south as you have described the actual conditions existing in the territories under discussion, that the greatest gradient on the surface is on the south or Snake Creek side, that there are no
433 large fissures on the south side or Snake Creek side, but that they are small fissures, that the fissures on the north side are as you have described in your own evidence and as Mr. McKay and Mr. Friendly testified to, large master fissures which traverse the country for a long distance and enter into this so-called Snake Creek area, that the country on either side of these larger fissures is broken and there are miles of underground workings existing on the north or Park City side following through and cutting across these master fissures, some of which workings exist below the horizon of the Snake Creek tunnel which is in controversy in this case and which is found on the south side or Snake Creek side, that the bedding of the country on the north or Park City side is northerly or away from the diorite or natural reservoir, that the bedding of the country, the dip of the bedding of the country on the south side or Snake Creek side is northerly or into or towards the diorite or natural reservoir, that these beddings are cut by fissures and joint planes running from one to another affording avenues for the flow of water from one bed down to another bed and along the beds in the direction of the dip of the beds, that the tunnel which is driven on the south side or Snake Creek side cuts two porphyry dikes and that in the cutting of those porphyry dikes it is determined, as testified to by Mr. Friendly, that they have acted as a natural underground dam for the storing back of waters, that the tunnel on the south or Snake Creek side has actually penetrated into the natural reservoir, that the tunnels on the north side have steadily been approaching the diorite or natural reservoir, that some of them have actually cut into the diorite or natural reservoir, a great many of them have been prosecuted along and through the master fissures which appear on that side, that in the prosecution of the tunnel the flow of water produced a hydrograph as shown by Exhibit 144 with the high peak after cutting the natural dam, a sudden falling off, and another high peak after cutting another dam, and a sudden falling off; that after entering the diorite the flow of water was largely increased over the flow of water which appeared in the tunnel before it struck the diorite; that there are no high peaks after you get into the diorite in comparison with the peaks which you find before you get into the diorite. Would you draw any other conclusion from those facts, assuming them to be correct as I have stated, than the conclusions which were drawn by Mr. Friendly and Mr. McKay?

434 A. It is a long question and I want to add one element that the hydrograph shows that is not included in it. The hydrograph shows in the sedimentaries storage zones that were relatively exhausted on being tapped by the tunnel, and that phenomenon is not so highly developed, it is not characteristic of

the diorite; it is characteristic of the sedimentaries; apparently the circulation in the sedimentaries was more confined to zones than it has been in the diorite, more general, probably the conditions there more homogeneous. With that addition and limiting my opinion to the limits as set out by you in the question, and adding the element that you incorporate of those two peaks in my first answer, that they circumscribe the reservoir, I am satisfied with my opinion that the conclusions of Mr. Friendly and Mr. McKay as to what would be expected are sound.

Assuming for the purpose of your question that it contains the facts that the two dikes caused an underground dam, there is no question but that when those two dikes were cut by the tunnel you would get your high peaks and a constant falling off, assuming they circumscribed the territory behind and that the territory behind included a great volume of water and the question of the sedimentaries which I brought in might being in additional peaks and the two peaks caused by the cutting of the water through the cutting of the dikes.

The Witness: I drew the conclusion that because the fluctuations as shown by the Mountain Lake hydrograph were -mogeneous both in reach and in time generally with the fluctuations shown on the Snake Creek and Lavina Creek hydrographs; that they were due to the same cause, the precipitation over the surface of that country.

I understand that the paper that has been marked "Exhibit 195" is a copy of a drawing which was made upon the board. The irregular top line represents the surface of the ground over which is found the word "Surface." The broken line dropped vertically from the highest point over which is written the word "divide" represents the portion referred to as the divide between the water on one side and the other, and the two parallel lines, vertically from the surface down, one marked from 1 to 2, the other from 3 to 4, represent the north and south limit of the diorite and of the portion that we referred to as the underground reservoir, and is so marked "diorite." The parallel lines on the left side, one under the other with an arrow pointing downwards toward the diorite and on the right hand side with an arrow pointing away from the diorite represent
435 the dip of the beds. The horizontal line running from 10 with an arrow at the end of it in the diorite, and the horizontal line running from 9 towards the diorite represents the two tunnels that have been referred to and the master fissures are represented by the black lines from 5 to 6 and 7 to 8 and the porphyry dikes by the hatched portion dropped vertically from the surface under the letter "P" for porphyry.

Exhibit 195 received in evidence.

Redirect examination:

Mr. Friendly was asked the other day about a pice of rock. I removed that piece of rock from its native site at the exit of spring No. 4 from the Hillside of Lavina Creek on Exhibit 139. There was

about seven feet of vertical exposure where I got that specimen. It was massive; there were heavy beds; they were beds in the neighborhood of three feet thick but were badly fractured both horizontally and vertically. There was an opening there that you could thrust your thumb in through which the spring issued.

Mr. McKay said there were four springs there that were not shown. I saw the one in the neighborhood of the porphyry exposure. As near as I can determine, the porphyry marked on Exhibit 139 between Spring No. 4 and Spring No. 5 is the porphyry in question. There was a spring there. I made this notation: "Igneous dike practically vertical; water issuing through vertical cracks from point 10 to 12 feet above the stream bed, thence down to the bottom; also from limestone fractures adjacent and up stream from the dike. On the left of the stream here the valley is occupied by detritus from the hillside." The strike of the lime and porphyry, speaking generally was transverse to the course of the stream and of the course of the tunnel, similar to the fissures and fractures indicated by the red lines on Exhibit 139.

I heard the testimony of Mr. Friendly in regard to the so-called porphyry dikes. I have a picture in my mind of Exhibit 169 which is a cross section of the tunnel along its length. Taking into consideration the facts I have just testified to with regard to the porphyry, and further the testimony of Mr. Friendly that the projection of the dike towards the surface, or the porphyry sill towards the surface, found at approximately 2,900 feet from the portal of the tunnel is unknown, and also the fact that the water which was struck 370 feet beyond this dike, back of a black limestone formation and also considering the fact that a second porphyry intrusion was found
436 substantially 4,900 feet in from the portal of the tunnel, that its projection towards the surface is unknown and merely assumed and that large flows of water were struck in the tunnel between 2,900 and 4,900 feet from the portal and coming from fissures and fractures, and that no porphyry dike has been traced to the west of the tunnel and that porphyry exposures have only been found on the east side of the tunnel, I do not think there is sufficient evidence to justify the assumption that the dikes mentioned circumscribe around and hold behind them in the form of storage the ground water lying between the two dikes and between the upper dike and the divide.

If a dike and sill developed at 2,900 feet from the portal of the tunnel was any such dike as Mr. Friendly had assumed there is no reason why the porphyry intrusion found at 4,900 feet in should not be as absolutely a dam.

If it is a fact as testified to by Mr. McKay that throughout the course of the tunnel, until they struck the diorite, there was only one place, and that about 10 feet long, where any water flowed from the bedding planes, and at that point there was a local fold, and at all other places in the tunnel the bedding planes yielded no water, were dry, and no water appeared in the tunnel except as came through the fissures crossing the tunnel, as indicated on 139, except slight drips from the roof, or comparatively small drips from the roof,

covering 600 feet out of the 10,600 feet of the tunnel then developed, I would say that the fact that the dip of the bedding planes was to the north would be comparatively immaterial.

It is common for all rocks to be broken by joint planes. As I have observed the country that has been testified to here, it is uncommonly broken. Where there are no seams between the beds, as has been testified to here, the plane of the bedding is simply a line of demarcation, a different character of material, it does not necessarily or probably follow that the joint cracks would follow the same course or dip or direction as the line of demarcation in the beds.

Prior to the interference with the particular country in question, both within the Park City side and the Snake Creek side of the divide, before any tunnels were driven, the discharge of the water from the sub-surface was controlled by the natural drainage depressions and the natural outflows from the ground water into the natural
drainage depressions. Assuming as illustrated on Exhibit
437 195, that the Park City side of the divide is flatter and does
not fall so precipitately as the other, and both sides contain natural master drainage depressions, other things being equal, the side with the deeper master drainage will drain the adjacent country to the lower level.

Notwithstanding the fact that there were master fissures on the Park City side, in a state of nature, the drainage outflow would be controlled by the depressions that they intersected, they would only drain to the depth of the natural depression and if waters deeper than the elevation of these depressions on the Park City side went out of the Mountains, they would have to go out on the Snake Creek side or some other side, and there is a lower level on the Snake Creek side.

I have seen the irrigated area of Midway and have heard the testimony as to its extent from Snake Creek, 3,200 to 3,500 acres. The fact that land has been brought under irrigation and reached the state that it has is a demonstration that while the country was in a state of nature, there was sufficient water flowing out of Snake Creek to so develop those lands.

Assuming, according to the testimony of Mr. Friendly and for the purpose of comparison with the Ontario and other tunnels and the hundreds of miles of mine workings on the Park City side, that there flowed in that total area of underground workings 33 cubic feet per second, and further assuming that the Snake Creek tunnel at the time it first reached the diorite, and before, flowed an average of nine cubic feet per second, and after it struck the diorite 16 cubic feet per second, and that that tunnel did not connect with one foot of any kind of workings,—under those circumstances the location of the Snake Creek tunnel was doubtless more favorably situated for the ready flow of water from that country.

Snake Creek tunnel goes underneath, or in close proximity, to the highest elevations the surface of which are excessively and intimately fractured and receive a very copious supply of water from rainfall; all of these things go into the relative advantage and the Snake Creek tunnel is favorably located for supply and for obtaining a deep invasion of the country in a relatively short lateral length, and it is

so favorably situated because the fissures that carry water within the Snake Creek drainage area are crossed by that tunnel, and there is no reason to doubt that the fissures that now flow water within the Snake Creek drainage area have flowed water *within the Snake Creek drainage area have flowed water* from time immemorial.

438 There has been in the state of Utah, beginning back in the 60's a very extreme period of aridity, small stream flow and great evaporation; then a period of accretion of water occurred, reaching a maximum before the 80's, then a general trend downward to 1903 or 1904 which brings you to a state of aridity comparable to that which existed in 1860; then the record shows it began to climb again. On this big wave of variation there are imposed smaller waves. In that general way we can speak of a cycle of plentiful water supply and a cycle of relatively small water supply. The largest cycle runs from 40 to 50 years and the smaller from eight to 10 years. In the eight to 10 year cycle there is nothing established by which you can figure the per cent of flow for one year comparable with another within that 10 year cycle. In my judgment with no sound basis for calculation or per cent of flow one year with another.

Other things being equal, the water gathering power of such an incision into the ground, (as the tunnel), is directly proportionate to the square feet of its area. Of course the opportunity is immensely greater to draw water where you have 300 or 400 miles of workings connected with the tunnel than where you have just one tunnel. The out-flow would indicate that the easiest way for water is into the Snake Creek drainage area, comparing the two.

Exhibit 197 received in evidence.

Cross-examination:

In other words, because the master drainage basin on the Snake Creek side is lower than the master drainage basin on the Park City side without any artificial incision into the area on either side, the natural drainage would be more towards the Snake Creek side; if the other elements are equal there is no question about it in my judgment.

My judgment is that in a state of nature the ground water divide was approximately near the topographic divide, and the waters sloping to the south ran to the south and those sloping to the north ran to the north; that on account of the increased slope towards the south the original ground water parting might have been and probably was slightly over into the Park City area because nature will equalize things and the ground water would pile up here to a place where it had equal opportunities to get away. If the openings leading to the surface were equally good in both areas to carry the surface water to the ground water, the ground water would be carried off more

439 rapidly towards the south because the slope was steeper. But I do not mean to say that these waters that lay down in the depths below the surface moved in one way or the other with any great velocity. I do think they were influenced directly by this maximum static head.

It is my opinion that from all of the conditions I have studied and learned of in studying this case, and in my former study, that because of the deeper master drainage basin on the Snake Creek side than on the Park City side, and because of the greater gradient on the Snake Creek side, that the greater outflow of water is to the Snake Creek drainage area, covered by Exhibit 173.

Redirect examination:

By records and personally in the field, I observed the drought periods of 1902, 1903 and 1904 and the causes and results. Referring to Exhibit 145 and particularly to the years 1914, 1915 and 1916, it is my judgment that no drought obtained and that springs, because of drought in that area should not have lessened their flow in that period. In fact, the four year period next prior to October 1917 was one of relatively large precipitation for the arid belt in which Snake Creek area is situated.

FRANK WENTZ, recalled by the defendants on sur-rebuttal, testified in substance as follows:

Assuming that a creek bed is composed of wash and cobble rock from the size of your two fists down at, and also above and below a particular point, it is not practicable to build a proper weir at that point and get all the water through it, it would be subject to leaks and part of the water would go through the coarse material and around the weir instead of through it; I have seen it tried.

1910 was not a high water year. I have a diagram which shows its relation to 1914 and 1917. The paper put on the board contains three diagrams. Exhibit 199 is a comparison of the flow of the Provo river for the years 1910, 1914 and 1917. Red represents the year 1910; the blue 1914 and the yellow 1917. The flow of the Provo river has become more regular of late years than it was before, mainly on account of the large diversion of high water in the Kamas valley and the valley near Heber. There is no such proportionate area irrigated along the banks of Snake Creek above the last point of diversion as there is along the Provo,—no such comparable
440 area, I would not expect the regularity of flow in Snake Creek, exclusive of springs, that I would in the Provo river.

I have taken the evidence furnished by Mr. Call's notes, and also given by him in court, as to the depths he found on the weir crest of the so-called Springer weir when he measured it in 1908 and with reference to that have prepared a diagram and hydrograph.

Mr. Springer's measurement was on March 7th and his next measurement was on March 10th. Mr. Call's measurement was on March 8th an- there was in one case two and one-eighth inches and in the other one and seven-eighth- inches difference in the two measurements, so I have used as a mean two inches. That would seem to show that if both measurements were fairly made that there was an error or improper condition in some appliance. I prepared that hydrograph all through with relation to the two inches of error. Considering the snow and ice, and the fact of the water being meas-

ured on a peg, the only conclusion I can come to is that the peg that Captain Springer testified to, that he took the depth on, must have been two inches higher than the crest.

Explaining Exhibit 200, the bottom of the exhibit is a blue print of exhibit 143 and to this is added a piece of cross section paper and the hydrograph of the flow is drawn to scale, using a two inch greater depth of water over the Springer weir than that reported by Captain Springer, that would be according to the testimony of Mr. Springer as to March 7th, 8th and 10th of 1908. In cubic feet per second in the calculations of Mr. Springer's testimony and Mr. Call's testimony for those dates the difference would be: Captain Springer's measurement on March 7th was a gauge height of 4⅜ inches; discharge 7.35 second feet. By Mr. Call for the 9th was a gauge height or a discharge of 13.14 second feet. Mr. Springer on March 10th, gauge height of 4¾ inches, with a discharge of 8.27 second feet. Upon the hydrograph the 2.6 second feet assumed for Springer spring, deducted from the Exhibit 143—I have deducted the same 2.6 second feet so that the two would be comparable. The difference between the flow as shown by the original hydrograph introduced by plaintiff and as amended by me according to Exhibit 200, according to Call's testimony shows a difference of approximately five second feet and that ratio follows all through, Mr. Call's measurements are higher.

441 Upon small streams of a second feet or less and also on small streams of three or four second feet, where the current is running swiftly with ripples and the filament of the current of the stream does not approach the meter parallel to its axis, meter measurements are in error directly as the current does not strike the meter directly. The current hits the cups at an angle, it does not give the revolutions.

I made experiments to determine that fact and found the factor of error on very shallow streams of that character as much as 20 per cent. The meter measurements show a less quantity than the weir measurements.

By request I took the testimony as given by Mr. Call and tabulated the flows on lower Snake Creek and also of the Mound ditch and made a comparison between the measurements so shown, showing plus and minus with the measurements of Mr. Stoner of those streams. The tabulation marked "Exhibit 201" shows the flow of the main channel of lower Snake Creek as made by Mr. Call and Mr. Barzee and to the right is the discharge given by Mr. Stoner on June 15th, 1918, and at the extreme right the two measurements, the total is shown, the average of each and the average difference.

The tabulation of the Mound ditch I mark "Exhibit 202" and shows the discharge by Mr. Call and Mr. Barzee and the measurement by Stoner and McKay. Eight of the measurements made by Call and Barzee showed a less discharge than the measurements by Stoner and McKay and three show a greater discharge. One of those includes the water of 1907. The average is minus .73 throughout the period.

Cross-examination:

To my mind this comparison has a tendency to show that most of these measurements by Mr. Call and Mr. Barzee weren't out of relation with what the channel actually carried, that is, they were not exceedingly excessive.

Redirect examination:

Q. On the 23rd of May were you with Mr. Van Wagenen, Mr. Alder, Mr. Tanner and myself in Midway, south of Midway along the road to Provo river, along Snake Creek and north and east and a little west of Midway?

A. Yes.

Mr. MacMillan: This is the question of marshy ground?

442 Mr. Wedgwood: Yes.

Mr. MacMillan: I will stipulate he will testify the same as Mr. Tanner did in regard to it.

Captain Springer recalled by the plaintiff for further direct examination testified in substance as follows:

I do not know whether or not after the weir over which I made my measurements was constructed, a leak occurred and they came back and repaired it. At the time I made my measurements the weir was absolutely tight.

After the weir was constructed the blade of the weir was changed, it was cut the wrong way. I cut the bevel the other way before any measurements were taken so that the sharp edge of the bevel was up-stream.

Cross-examination:

I did not take the plank out or off. It was something like one and three-fourths inches thick. I widened the opening about three and one-half inches. I sawed the ends out with the water running.

I did not change the bevel on the bottom of the crest of the weir, as far as I know that was up-stream all the time.

O. N. Friendly recalled by plaintiff for further direct examination testified in substance as follows:

It is not proper to take a current meter measurement by holding the meter over the crest of the weir. In my opinion the conclusions which were drawn by Mr. Wentz from his Exhibit 200, which is a hydrograph drawn by him of the depths which were taken over the crest of the weir cannot logically be drawn.

Jacob Probst, a witness produced by the plaintiff in rebuttal, testified in substance as follows:

I constructed a weir in Snake Creek just below Captain Springer's house for Mr. Murdock. It put the gauge in. When I got through

it was level with the crest of the weir to the best of my knowledge and instruction.

I took a 2 x 2 or 2 x 3 pole about eight feet long and set it back 15 feet from the crest of the weir or from the feather edge in
443 the stream, placed it there solid so it would stand, and then I took a square and measured from zero up to the extent of about 2½ feet. I obtained a straight edge and placed it on the crest of the weir back to the zero mark on the gauge and took a spirit level and placed on there, and it was as level as I could make it at the crest with the spirit level.

Cross-examination:

When I put my straight edge on I ran it back fifteen feet. The water was nearly up to my waist in [placed]. I put my straight edge on top of the weir crest. I had already marked "zero" on there, and the bottom of my straight edge come to zero and my [leve-], would be on top. The water was within six inches or a foot of my zero mark, I could not tell you exactly. By placing the straight edge on the crest of the weir and holding it back on zero on the gauge would tell me the level.

Q. I am asking you how you could see whether the lower edge of your straight edge was at zero, because the lower edge would have to be there when the water was within six inches of that zero point?

A. I could see under it all right.

Q. You are that kind of mechanic that can do that kind of job that way?

A. Yes. I could see under the straight edge all right.

Q. What did you do, lean over, stick your head down into the water?

A. I would stoop over and look under.

Q. That is the way you did it?

A. Yes, sir.

Q. There is no trouble about the weir crest, the straight edge would rest there, but the water being six inches or a foot, in order to see to determine whether that was accurately there you would at l-ast have to get your eyes on the same plane as the bottom, wouldn't you?

A. Yes, sir.

Q. You would either have to stand on your head or sit down in the water until your eyes were right on a level with the two inch proposition.

A. Yes, sir.

(Stipulation for the Approval of the Statement of Evidence, etc.)

The foregoing statement of evidence, together with the exhibits and documentary evidence therein referred to and hereby referred to and made a part hereof, constitutes and contains all of the evidence received in said cause in any wise material to a consideration of the appeal herein; and

444 It is stipulated and agreed that the same is proposed and lodged with the Clerk in time and that the same may be ap-

proved and settled by the District Court or Judge thereof without notice.

Dated this 9th day of February, 1920.

E. A. WEDGWOOD,
A. B. IRVINE,
SAM D. THURMAN,
Solicitors for Appellants.
ANDREW HOWAT,
J. A. MARSHALL,
H. R. MACMILLAN,
B. C. CROW,
Solicitors for Appellee.

(*Order of the District Court Approving the Statement of Evidence.*)

In this cause the matter coming on this day for a settlement of the evidence to be included in the record on appeal and the parties by their solicitors consenting thereto:

It is ordered that the foregoing statement of the evidence be, and it is hereby, settled, allowed and approved as a true, complete, and properly prepared statement of the evidence in said cause and sufficient to properly present to the Circuit Court of Appeals the evidence pertinent to the issues raised on said appeal.

Dated this 10th day of February, 1920.

(Sgd.) TILLMAN D. JOHNSON,
District Judge.

Endorsed: Filed in the District Court on February 10, 1920.

(*Order Fixing Amount of Bond on Appeal.*)

The foregoing appeal is allowed as prayed for this 21st day of June, 1919, and bond fixed at the sum of $2,500.00 same to act as supersedeas as to costs and if supersedeas of decree is desired otherwise than as to costs additional bond in the sum of $12,000.00 to be approved by the Clerk, the same to act as such supersedeas.

(Signed) TILLMAN D. JOHNSON,
District Judge.

Endorsed: Filed in the District Court on June 21, 1919.

445 (*Petition for and Order Allowing Appeal.*)

To the Honorable Tillman D. Johnson, District Judge:

The above named defendants feeling aggrieved by the decree rendered and entered in the above entitled cause on the first day of January, A. D. 1919, do hereby appeal from said District Court to the United States Circuit of Appeals for the Eighth Circuit for the reasons set forth in the assignment of errors filed herewith, and they pray that their appeal be allowed and that citation be issued as provided by law, and that a transcript of the record proceedings and documents

upon which said decree was based, duly authenticated be sent to the United States Circuit Court of Appeals for the Eighth Circuit, under the rules of such Court in such cases made and provided.

And your petitioner further prays that the proper order relating to the security to be required of them be made.

(Signed) E. A. WEDGWOOD,
A. B. IRVINE,
S. D. THURMAN,
E. A. WALTON,
T. D. WALTON,
Solicitors for Appellants.

The foregoing appeal is allowed as prayed for this 21st day of June, 1919, and bond fixed at the sum of $2,500.00 same to act as supersedeas as to costs and if supersedeas of decree is desired otherwise than as to costs additional bond in the sum of $12,000.00 to be approved by the Clerk, the same to act as such supersedeas.

(Signed) TILLMAN D. JOHNSON,
District Judge.

Endorsed: Filed in the District Court on June 21, 1919.

(*Assignment of Errors.*)

Now comes the defendants in the above entitled cause and files the following assignment of errors upon which it will rely upon its prosecution of the appeal in the above entitled cause, from the decree made by this Honorable court on the first day of January, 1919.

446 That the United States District Court for the District of Utah erred, in the trial and decision of said cause in the following particulars:

I.

Plaintiff having elected to introduce no evidence under its bill but to rest its case upon the pleadings in the cause the court erred in permitting the plaintiff, against the objection of defendants to thereafter introduce any evidence whatever at the trial of said cause.

II.

The court erred in permitting plaintiff, against the objection of defendants, to introduce evidence in support of its bill, after defendants had rested their case; plaintiff having theretofore elected to introduce no evidence in support of its bill prior to the introduction of evidence on the part of the defendants.

III.

The court erred in permitting plaintiff, after the close of defendants' case to introduce any evidence whatever other than evidence pertaining to the appropriation and use of water by the Midway Irriga-

tion Company, and the quantity to which it was entitled to use under its appropriation.

IV.

The Court erred in permitting plaintiff, against objection of defendants and in rebuttal of defendants' evidence to introduce evidence as to the history of the tunnel; conditions in the tunnel; water flow in the tunnel and geological conditions and their relations to the flow of water from the tunnel.

V.

The court erred in denying defendants' motion, made at the close of its testimony, that an order be entered dismissing plaintiff's bill.

VI.

There being no allegation in plaintiff's bill or reply that it had any beneficial use for the waters involved in the action, either by itself, or by license or lessee, other than for power, and its right to its use for such purposes not being contested, the court eerred in permitting plaintiff to introduce any evidence in rebuttal of defendants' evidence.

447 VII.

The court erred in sustaining plaintiff's bill as amended and in decreeing that plaintiff was the owner of all of the water flowing in and from that certain tunnel belonging to plaintiff.

VIII.

The court erred in sustaining plaintiffs' bill *and* amended and in decreeing that plaintiff is in possession "of all of the water flowing in and from that certain tunnel belonging to plaintiff."

IX.

The court erred in sustaining plaintiff's bill as amended and in decreeing that plaintiff is "entitled to the possession of all of the water flowing in and from that certain tunnel belonging to plaintiff * * *"

X.

The court erred in sustaining plaintiff's bill as amended and in decreeing "that plaintiff is the absolute owner of the right to use said water and to divert said water or an equivalent amount thereof, less the amount of the water lost between the portal of the tunnel and the point of diversion * * *"

XI.

The court erred in sustaining plaintiff's bill as amended and in decreeing "that said title of plaintiff in and to said waters and the right to use and divert the same be, and the same hereby is confirmed and forever quieted. * * *"

XII.

The court erred in sustaining plaintiff's bill as amended and in decreeing that said defendants "are hereby perpetually enjoined from claiming said water or any part thereof. * * *"

XIII.

The court erred in adjudging the ownership of the right to the use of said water against the defendant the Midway Irrigation Company as set up in its counter-claim.

XIV.

The decree is for the wrong party.

XV.

The decree for the plaintiff is contrary to the evidence and the holding of the court that the burden of proof was upon the plaintiff and that it had failed to sustain the same.

448 XVI.

The decree for the plaintiff is contrary to the evidence and contrary to the finding of the court that the defendant the Midway Irrigation Company had, prior to the construction of plaintiff's tunnel appropriated all of the flowing water of Snake Creek during the irrigation season of each year.

XVII.

The decree for the plaintiff is contrary to the evidence and to the law relating to the appropriation of the waters of natural streams for irrigation and other beneficial purposes.

XVIII.

The court erred in its finding and conclusion stated in its written decision or opinion as follows: "The plaintiff is in possession of and has control of the tunnel, and no reason has occurred to me why the ownership of the land through which the [tun-el] is constructed should have any controlling influence in the determination of the case * * *"

XIX.

The court erred in its finding and conclusion stated in its written decision or opinion as follows: "A large part of the evidence upon the matter under consideration is opinion evidence, and that which is not, consisting of measurements made by various parties, is insufficient both in quality and number to warrant a judicial decision with any sense or feeling of certainty that the decision was just or in accord with the actual facts."

XX.

The court erred in its finding and conclusion stated in its written decision or opinion, as follows: "Of course the important fact to be determined is whether there is more water in the creek immediately above the headgates of the defendant company than there had been previous to the construction of the tunnel * * * when it is remembered that the water of the stream was diverted and used through a number of separate canals and ditches, and when we do not know in any particular case or year what lands were cultivated or what crops were cultivated thereon, or the nature of the seasons compared one with another, * * * the mind is not at all convinced that the contention of the defendant company is not more likely to be correct than the contention of the plaintiff company nor is the uncertain state of mind above stated relieved when consideration is given
449 to the testimony that one second foot of water is necessary to the proper irrigation of seventy acres of land and that said 3,500 acres have been brought into a state of cultivation by the use of waters of Snake Creek. * * * One must know with more certainty than appears by the evidence in this case the kind and acreage of the crops grown upon the land," for the reason that such finding is not supported by and is contrary to the evidence in the case.

XXI.

The court erred in its finding and conclusion stated in its written decision or opinion as follows: "All the measurements taken together are entirely too few in number to justify any general conclusion to be drawn therefrom, the same being contrary and not supported or sustained by the evidence.

XXII.

The court erred in its finding and conclusion stated in its written decision or opinion, as follows: "I am not convinced that the measurements introduced in evidence are sufficient in this case to justify a conclusion of the ultimate fact in dispute between the parties" the same being contrary to and not sustained by the evidence.

XXIII.

The court erred in its finding and conclusion stated in its written decision or opinion, as follows: "Under the ordinary and usual defi-

nitions I am satisfied that the water flowing from the tunnel is percolating water" same being contrary to and not supported by the evidence.

XXIV.

The court erred in its finding and conclusion stated in its written decision or opinion that the common law rule in regard to the ownership of sub-surface water was admitted to exist in this State, either as a matter of fact or law [an-] further so erred in finding that it was his [cuty] to recognize and apply such rule, until a modification shall have taken place, or at all.

XXV.

The court erred in applying the so-called "common law rule" in regard to the ownership of underground waters in this case in the face of its findings in its written decision or opinion that "I am constrained to hold, in view of the clearly expressed opinion of
450 the Supreme Court of the State that a modification of the common law rule * * * must take place" and "if in the future the Supreme Court of the State shall definitely adopt the American rule, I shall have no hesitation in following such decision, notwithstanding the decision of this case, unless this court should be bound upon the question by the decision of the question by an appellate tribunal controlling in this court.

XXVI.

The court erred in its finding and conclusion stated in its written decision and opinion that the only question presented in that case for decision, and the only question discussed and decided by the opinion in the case (Mountain Lake Mining Company vs. Midway Irrigation Company, 47 Utah 346) was as to the burden of proof.

XXVII.

The court erred in rendering a decree for plaintiff in the face of, and contrary to its finding and conclusion in its written decision or opinion, as follows: "Upon the whole case I am of the opinion that the plaintiff has failed to sustain the burden of proof upon its claim that the water encountered in this tunnel, or any definite part or portion thereof, was new or developed water.

XXVIII.

The court erred in permitting the witness H. L. Stoner against the objection and exception of defendants to testify in relation to the percentage of error in float measurements made of mountain streams and basing his testimony upon theoretical computations of the surface velocity of such streams and in denying defendants' motion to strike out said testimony, the substance of said testimony being that the

evidence introduced by defendants or measurements of the streams in question in this suit was of no value and basing such statement upon assumed mean velocity of the streams in controversy at 85% of their surface velocity and basing such assumption upon measurements made by other persons of streams of far greater size and of different character from the streams in question, and upon such basis, assuming and testifying that the surface velocity of the streams in question and the streams as to which he testified were uniform regardless of depth and other physical features, even to as shallow a depth as three inches and where practically the entire depth was occupied by the body of the current water used by him in attempting to ascer-
451 tain the velocity of the stream at six-tenths of its depth occupying practically the entire depth of the stream.

XXIX.

The court erred in permitting the introduction of plaintiff's exhibit No. 126 in evidence, against the objection and exception of defendant, and also so erred in permitting the witness E. F Ledyard to testify in regard to the age of the lucern shown thereon, and that the age of the lucern in the district was from eight to ten years, and that a maximum yield of lucern could not be expected from the fields of the age testified to, and also whether the crops he examined showed evidence of a lack of water.

XXX.

The court erred in permitting the witness Fred Mathews, over the objection and exception of defendant to testify that maximum crops are not obtained unless a system of crop rotation is practiced.

XXXI.

The court erred in permitting the witness, F. S. Harris, over the objection and exception of defendant to testify that there is no doubt but what farmers use more water than they need and that by a process of reasoning and experimenting it is shown that too much water reduces crop yield.

XXXII.

The court erred in permitting the witness, H. L. Stoner, over the objection and exception of defendant to testify that by resorting to figures referred to he could get, without any theory at all, the actual flow or velocity of the water at the surface over a stated point.

XXXIII.

The court erred in permitting the witness H. L. Stoner over the objection and exception of defendants to testify that Provo river at a certain point where the same was fifty-one feet in width and had

a cross-section area of sixty-six feet; was a stream which would approximate with the streams where the measurements were taken from which the coefficients of the table in relation to which he testified were developed.

XXXIV.

The court erred in admitting in evidence plaintiff's Exhibit No. 134, against the objection and exception of the defendants.

452 XXXV.

The court erred in permitting the witness, J. W. Orrock over the objection and exception of the defendants to state why water that was sufficient to run one unit of a hydro-electric power station in question was not sufficient to run two units.

XXXVI.

The court erred in permitting the witness, J. W. Orrock. over the objection and exception of the defendants to testify that the power plant in question was using all of the water that was available for use at the point of diversion.

XXXVII.

The Court erred in admitting in evidence the plaintiff's exhibits Nos. 135, 136, 137 and 138 against the objection and exception of defendants.

XXXVIII.

The court erred in permitting the witness, J. W. Orrock, against the objection and exception of defendants, to testify that in the year 1916 and 1917 at a power plant of which he was in charge, its two units were not used all of the time during the low water period.

XXXIX.

The court erred in permitting the witness, O. N. Friendly against the objection and exception of defendants to testify as to how he made measurements as to which he testified and comprising measurements of Snake Creek and Lavina Creek at points substantially opposite the Snake Creek tunnel and not comprising measurements which would show the total flow of Snake Creek down at the lowest point of diversion of the defendant, Midway Irrigation Company.

XL.

The court erred in admitting in evidence plaintiff's Exhibit No. 141 against the objection and exception of the defendants.

XLI.

The court erred in admitting in evidence plaintiff's Exhibits Nos. 139, 140, 141, 142, 143, 144, 145, 146, 147, 148 and 149, against the objection and exception of defendants.

453 XLII.

The court erred in admitting in evidence plaintiff's Exhibits Nos. 153, 154, and 155 against the objection and exception of defendants.

XLIII.

The court erred in permitting the witness O. N. Friendly against the objection and exception of defendants to testify that the workings shown on exhibits 153, 154, and 155 were receiving water from fissures referred to.

XLIV.

The Court erred in admitting in evidence plaintiff's Exhibits No. 156 and 157 against the objection and exception of defendants.

XLV.

The court erred in admitting in evidence plaintiff's Exhibits No. 158 and 159 against the objection and exception of defendants.

XLVI.

The court erred in receiving in evidence plaintiff's Exhibit No. 168 against the objection and exception of defendants.

XLVII.

The court erred in receiving in evidence plaintiff's Exhibits Nos. 168, 169, 170, 171, 172, and 173.

[XLVII-.]

The court erred in permitting the witness, G. R. McKay, against the objection and exception of defendants to answer the following question:

Q. I will ask you, Mr. McKay, if there is any opening or channel which appears in the ground cut by Snake Creek tunnel from which any geologist however well read or expert he may be or however wide his experience may be can do more than give an opinion as a geologist as to how the water traveled beneath the surface of the ground which is cut by the Snake Creek tunnel?

Mr. Wedgwood: I object to it as incompetent.
The Court: I think he may answer.
Mr. Wedgwood: Save an exception:

454 A. No, there is nothing in the tunnel itself which shows the direction the water was taking when it was cut by the tunnel outside of the dip of the beddings and the strike of the fissures, strike and dip of the fissures.

XLIX.

The Court erred in admitting in evidence plaintiff's Exhibit No. 37 against the objection and exception of defendant.

L.

The court erred in admitting evidence, against the objection and exception of defendants, in relation to plaintiff's Exhibit No. 175, and in so receiving said 1330 Exhibit in evidence.

LI.

The court erred in permitting the witness, O. N. Friendly, against the objection and exception of defendants to answer the following question:

Q. Assuming the fissures represented on Exhibits 153 to 155 continue from the Park City mining district into the Bonanza Flat country and practically to the divide between the Bonanza Flat country and the Big Cottowood side, thus carrying it through the diorite, and that these workings which are shown on Exhibits 153 to 155 have been driven forward in these fissures, not only the upper fissure but the other fissures which enter into the Bonanza Flat country, what effect, if any, in your opinion, would the driving or advance of these fissures towards the diorite have upon water in the diorite?

Mr. Wedgwood: I object to it as incompetent.
The Court: He may answer subject to your objection.
Mr. Wedgwood: Save an exception.

A. As the fissures are advanced they will undoubtedly draw more water.

LII.

The court erred in permitting the witness, O. N. Friendly, against the objection and exception of defendants to testify as to the number of acres covered by the Judge holdings, the substance of said testimony being that the tunnel was run for the development of the Judge property Mountain Lake property and other property or properties which might want to be served by it and that the Judge holdings embraced approximately twenty-five hundred acres, of ground.

455 LIII.

The court erred in permitting the witness, O. N. Friendly, against the objection and exception of defendants to testify that the value of ores extracted from the Daly Judge properties was twenty million dollars and of the West Company under the same management, in the neighborhood of twenty-five million dollars.

LIV.

The decree is erroneous and void for uncertainty in its description of the subject-matter of the decree, especially in respect to amount or quantity.

LV.

The decree is erroneous and void for want of jurisdiction in the court to entertain said suit or to make the decree herein.

Wherefore, the appellants pray that the said decree be in all respects reversed and held for naught and for such other and further relief as to equity belongs.

(Signed) E. A. WEDGWOOD,
A. B. IRVINE,
S. D. THURMAN,
E. A. WALTON,
T. D. WALTON,
Solicitors for Appellants.

Endorsed: Filed in the District Court on June 21, 1919.

(*Order Extending Time to File Transcript.*)

Good cause appearing therefor, to-wit: that because of the volume of evidence herein and the length of time required to transcribe and abstract the same additional time is needed to settle statement of evidence herein, it is ordered, on motion of defendants who have appealed herein, that time to file the record and docket the cause on appeal to the United States Circuit Court of Appeals for the Eighth Circuit is hereby enlarged by the period of forty (40) additional days.

Dated this 21st day of June, 1919.

(Signed) TILLMAN D. JOHNSON,
District Judge.

Endorsed: Filed in the District Court on June 21, 1919.

* * * * * * *

456 (*Bond on Appeal.*)

Know all men by these presents:

That we, Midway Irrigation Company and Wilford Van Wagonenen, as principals, and American Surety Company of New York, as

surety, are held and firmly bound unto the Snake Creek Mining & Tunnel Company in the sum of two thousand five hundred dollars, lawful money of the United States, to be paid to it and its successors; to which payment, well and truly to be made, we bind ourselves, and each of us, jointly and severally, and our successors by these presents.

Sealed with our seals and dated this 24th day of June, 1919.

Whereas, lately, to-wit, on the 1st day of January, 1919, in the District Court of the United States for the District of Utah, in a suit pending in said court between Snake Creek Mining & Tunnel Company, a corporation, plaintiff, and Midway Irrigation Company, a corporation, and Wilford Van Wagonenen, defendants, a decree was rendered against said defendants and the said defendants have obtained an appeal from said court to reverse the decree in the aforesaid suit, and a citation directed to the said plaintiff citing and admonishing it, to be and appear before the United States Circuit Court of Appeals for the Eighth Circuit, at the City of St. Louis, State of Missouri, sixty days from and after the date thereof.

Now, therefore, the condition of this obligation is such that if the above named Midway Irrigation Company and Wilford Van Wagenen shall prosecute their said appeal to effect and answer all damages and costs including costs now taxed against them, if they fail to make good their plea, then the above obligation shall be void; otherwise to remain in full force and effect.

MIDWAY IRRIGATION COMPANY,
By WILFORD VAN WAGENEN,
President.
WILFORD VAN WAGENEN.
AMERICAN SURETY COMPANY OF NEW YORK,
By W. D. HABISH,
Resident Vice President.

Attest:
[SEAL.] H. BAY,
Resident Asst. Secretary.

457 STATE OF UTAH,
County of Wasatch, ss:

On this 24th day of June, 1919, personally appeared before me, Midway Irrigation Company, by Wilford Van Wagenen, its President, and Wilford Van Wagenen, to me known to be the persons described in and who duly executed the foregoing instrument as parties thereto and said Wilford Van Wagenen for himself acknowledged to me that he executed the same, and under oath further acknowledged that he executed the same on the part of, and as the act of, the Midway Irrigation Company, by authority of a resolution of its board of directors.

[SEAL.] (Signed) ELLEN PYPER,
Notary Public.

My commission expires: Oct. 6, 1922.

Statutory Affidavit for Corporate Surety—Utah.

STATE OF UTAH,
County of Salt Lake, ss:

Personally appeared before me, a Notary Public in and for Salt Lake County, State of Utah, W. D. Habish, who being first duly sworn on oath deposes and says that he is Resident Vice President of the American Surety Company of New York, a corporation organized under the laws of the State of New York, and that he is duly authorized to execute and deliver the foregoing obligation; that the said American Surety Company of New York is authorized to execute the same and has complied with all the laws of the State of Utah in reference to becoming sole surety upon bonds, undertakings and obligations. Affiant further says that William E. McKell whose address is Salt Lake City, Utah, has been appointed as attorney upon whom process for the State of Utah may be served according to law.

(Signed) W. D. HABISH.

Subscribed and sworn to before me this 24th day of June, 1919.

[SEAL.] (Signed) L. E. BEUSCHELL,
Notary Public.

The within bond is approved both as to sufficiency and form this 24th day of June, A. D. 1919.

(Signed) JOHN W. CHRISTY,
Clerk.

Endorsed: Filed in the District Court on June 24, 1919.

* * * * * * *

458 (*Order, September* 27, 1919, *Extending Time to File Statement of the Evidence.*)

Good cause appearing therefor, and the parties having stipulated thereto, it is hereby ordered that time to lodge, serve and settle statement of evidence and record herein, for the purposes of appeal, and also time on the part of appellee to propose objections or amendments in respect to statement of evidence and record, is hereby enlarged to and including the 1st day of January, 1920.

Dated, this 27th day of September, A. D. 1919.

(Signed) TILLMAN D. JOHNSON,
District Judge.

Endorsed: Filed in the District Court on September 27, 1919.

(*Order, September* 27, 1919, *Extending Time to File Transcript.*)

Good cause appearing therefor, as appears by the stipulation of the parties filed, it is ordered that time to file the record and docket this cause on appeal to the United States Circuit Court of Appeals

for the Eighth Circuit, is hereby enlarged to and including the 1st day of February, 1920.

Dated, this 27th day of September, A. D. 1919.

(Signed) TILLMAN D. JOHNSON,
District [Court].

Filed and entered Sept. 27, 1919.
JOHN W. CHRISTY,
Clerk.

Endorsed: Filed in the District Court on September 27, 1919.

* * * * * * *

(*Order, December* 20, 1919, *Extending Time to File Statement of Evidence and Transcript.*)

Good cause appearing therefor, and the parties having stipulated thereto, it is hereby ordered that time to lodge, serve and settle statement o fevidence and record herein, for the purposes of appeal, and also time on the part of appellee to propose objections or amendments in respect to statement of evidence and record, is hereby enlarged to and including the 1st day of February, 1920, and it is further ordered that the time for docketing this cause on
459 appeal be enlarged to and including the first day of March, 1920.

Dated this 20th day of December, A. D. 1919.

(Signed) TILLMAN D. JOHNSON,
District Judge.

Endorsed: Filed in the District Court on December 20, 1919.

(*Order, January* 30, 1920, *Extending Time to File Statement of Evidence.*)

Good cause appearing therefor, and the parties having stipulated thereto, it is hereby ordered that time to lodge, serve and settle statement of evidence and record herein, for the purposes of appeal, and also time on the part of appellee to propose objections or amendments in respect to statement of evidence and record, is hereby enlarged to and including the 20th day of February, 1920.

Dated this 29th day of January, 1920.

(Signed) TILLMAN D. JOHNSON,
Judge.

Endorsed: Filed in the District Court on January 30, 1920.

(*Stipulation as to Transmission of Original Exhibits to Appellate Court.*)

It is stipulated and agreed by and between the parties hereto that all the exhibits in this cause shall be transmitted to the Clerk of the

United States Circuit Court of Appeals for the Eighth Circuit before the hearing of the cause in said court and the same may be used upon the hearing of said cause in conjunction with the printed record and shall be considered as a part of the record on appeal herein.

460 It is also agreed that the printing of the record on appeal herein shall be under the supervision of the Clerk of the said Circuit Court of Appeals.

Dated this 9th day of February, 1920.

(Signed) A. B. IRVINE,
S. D. THURMAN,
E. A. WEDGWOOD,
Solicitors for Defendants.
H. R. MACMILLAN,
HOWAT, MARSHALL, MACMILLAN & CROW,
Solicitors for Plaintiff.

Endorsed: Filed in the District court on February 9, 1920.

(Stipulation as to the Use and Printing Exhibits.)

It is hereby stipulated and agreed by and between the parties hereto that none of the exhibits herein is required to be reproduced for, or incorporated into, the printed record, and that either party may reproduce and incorporate in its brief any of such exhibits, and if such is done, they may be considered as though they were so reproduced in the printed transcript of record herein.

It is further stipulated and agreed that said exhibits shall remain in this court until thirty (30) days before the date set for the argument of this cause in the Circuit Court of Appeals.

Dated this 16th day of February, 1920.

(Signed) A. B. IRVINE,
S. D. THURMAN,
E. A. WALTON,
Solicitors for Defendants-Appellants.
H. R. MACMILLAN,
HOWAT, MARSHALL, MACMILLAN & CROW,
Solicitors for Plaintiff-Appellee.

Endorsed: Filed in the District Court on February 16, 1920.

* * * * * * *

461 (*Citation and Acknowledgment of the Receipt of a Copy.*)

SNAKE CREEK MINING & TUNNEL COMPANY, a Corporation, Plaintiff,

vs.

MIDWAY IRRIGATION COMPANY, a Corporation, and WILFORD VAN WAGENEN, Defendants.

United States of America to Snake Creek Mining & Tunnel Company:

You are hereby cited and admonished to be and appear in the United States Circuit Court of Appeals for the Eighth Circuit, at the City of St. Louis, Missouri, sixty days from and after the day this citation bears date, pursuant to an appeal allowed and filed in the Clerk's office of the District Court of the United States for the District of Utah, Central Division, wherein Midway Irrigation Company and Wilford Van Wagenen are appellants and you are appellee, to show cause, if any there be, why the decree rendered against the said appellants as in said appeal mentioned should not be corrected, and why speedy justice should not be done the parties in that behalf.

Witness, the Honorable Tillman D. Johnson, Judge of said District Court, this 21st day of June, A. D. 1919.

[Seal U. S. District Court, Dist. of Utah.]

TILLMAN D. JOHNSON,
Judge of United States District Court.

Attest:
JOHN W. CHRISTY,
Clerk,

Copy received this 21 day of June, 1919, also copy of petition for and allowance of appeal and assignment of errors.

HOWAT, MARSHALL, MACMILLAN & NEBEKER,
Solicitors for Snake Creek Mining & Tunnel Company.

Lodged in Clerk's Office June 21, 1919.

JOHN W. CHRISTY,
Clerk.

462 (*Designation of Appellants as to Printing Record.*)

United States Circuit Court of Appeals, Eighth Circuit.

MIDWAY IRRIGATION COMPANY, a Corporation, and WILFORD VAN WAGENEN, Appellants,

vs.

SNAKE CREEK MINING & TUNNEL COMPANY, a Corporation, Appellee.

The Clerk of said Court will please incorporate into the printed record the following parts of the record, being all the appellants think necessary for the consideration of the errors assigned, namely:

Bill in equity.
Answer and counter-claim.
Reply to counter-claim.
Opinion of Court.
Decree.
Order fixing bond on appeal.
Petition for appeal.
Assignment of errors.
Order enlarging time for filing appeal 40 days additional.
Citation on appeal.
Appeal bond.
Order enlarging time for settlement evidence and filing record to Jan. 1, 1920.
Order on stipulation to Feb. 1, for evidence and Mar. 1, 1920, for filing record.
Condensed statement of evidence.
Stipulation to transmit original exhibits to Circuit Court of Appeals.
463 Stipulation in re exhibits, filed Feb. 16, 1920.

Dated this 8 day of March, 1920.

T. D. WALTON,
E. A. WALTON,
Solicitors for Appellants.

Copy received this 8 day of March, 1920.

ANDREW HOWAT,
JOHN A. MARSHALL,
H. R. MacMILLAN,
BEN S. CROW,
Solicitors for Appellee.

Indorsed: Filed in the U. S. Court of Appeals, March 17, 1920.

(Clerk's Certificate to Transcript.)

United States of America,
District of Utah, ss:

I, John W. Christy, Clerk of the District Court of the United States for the District of Utah do hereby certify that the foregoing pages numbered from one to seven hundred and thirteen, both inclusive, contain a full, true and complete copy and transcript of the record, proceedings and papers called for in the præcipe for said transcript in that certain suit in equity numbered 3717 on the dockets of said Court, wherein Snake Creek Mining & Tunnel Company is plaintiff and Midway Irrigation Company, et al., are defendants, as full, true and complete as the originals thereof now remain on file and of record in my office, the following papers and proceedings being omitted because of not being specified in said præcipe, to-wit:

Jan. 13, 1914. Summons & return served.
Feb. 1, 1915. Order setting for trial.
Mar. 4, 5, 8, 9, 10, 11, 12, 15, 16, 17, 18, Entries trial resumed.
Mar. 19, Entry trial resumed and taken under advisement.
Jul. 26, 1916. Order restoring cause to trial calender.
Jul. 26, 1917. Order setting for trial Nov. 5, 1917.

464

Nov. 17, Order setting for trial Feby. 6, 1918.

Jany. 15, 1918. Order for withdrawal Exhibit 1.
29, Order extending time of withdrawal.
Mar. 30, Order setting for trial June 3, 1918.
May 14, Order resetting for trial for May 27, 1918.
27, Order trial begun.
28, 29, 31, June 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 24, 25, 28, Jul. 1, 2, 3, 5, and 6, Orders trial resumed.
Jul. 8, Order trial resumed and concluded.
20, Order arguments concluded and under advisement.
Dec. 4, 1918. Order allowing withdrawal exhibit.
20, Order setting for hearing on settlement decree.
Jan. 1, 1919. Form decree proposed by defendant.
Certification of Judgment Roll.
4, Cost bill of plaintiff.
10, Defendants' appeal from taxation by Clerk.
28, Order Court retaxing plaintiff's costs at $570.77.
Jun. 21, 1919. Notice of motion to extend time to settle evidence.
Jan. 30, 1920. Stipulation extending time to settle evidence.

465 I further certify that the original citation in this cause is hereunto annexed and transmitted herewith.

In witness whereof, I have hereunto set my hand and affixed the

seal of said court at Salt Lake City, in said District, this 24th day of February, in the year of our Lord nineteen hundred and twenty, and the one hundred forty-fourth of the Independence of the United States of America.

[Seal of U. S. Dist. Court, Dist. of Utah.]

JOHN W. CHRISTY,
Clerk U. S. District Court for the District of Utah.

Filed Mar. 1, 1920.
E. E. KOCH,
Clerk.

(*Stipulation to Insert Reproductions of Exhibits* 1 *and* 139 *in Copies of the Printed Record.*)

United States Circuit Court of Appeals, Eighth Circuit.

MIDWAY IRRIGATION COMPANY, a Corporation, and WILFORD VAN WAGENEN, Appellants,

vs.

SNAKE CREEK MINING & TUNNEL COMPANY, a Corporation, *Appellee.*

It is hereby stipulated and agreed by and between the parties hereto that the photostat reproductions of Exhibits 1 and 139, now in the hands of the Clerk, may be inserted in the printed record herein.

Dated this 9th day of July, 1920.

A. B. IRWINE,
S. D. THURMAN,
E. A. WALTON,
T. D. WALTON,
Solicitors for Appellants.
ANDREW HOWAT,
JOHN A. MARSHALL,
H. R. MACMILLAN,
B. S. CROW,
Solicitors for Appellee.

Endorsed: Filed in the U. S. Circuit Court of Appeals, July 13, 1920.

466 (Here follow Exhibit 1 and Plaintiff's Exhibit 139, marked pages 467-469.

470 And thereafter the following proceedings were had in said cause, in the Circuit Court of Appeals, viz:

TOPOGRAPHIC

PLAT

SNAKE CREEK WATERSHED.

Scale 1 Inch = [illegible] Feet
Traced By T. F. [illegible]
Feb 1913

302

Snake Creek Mining Co.
v
Midway Irrigation Co

$466.

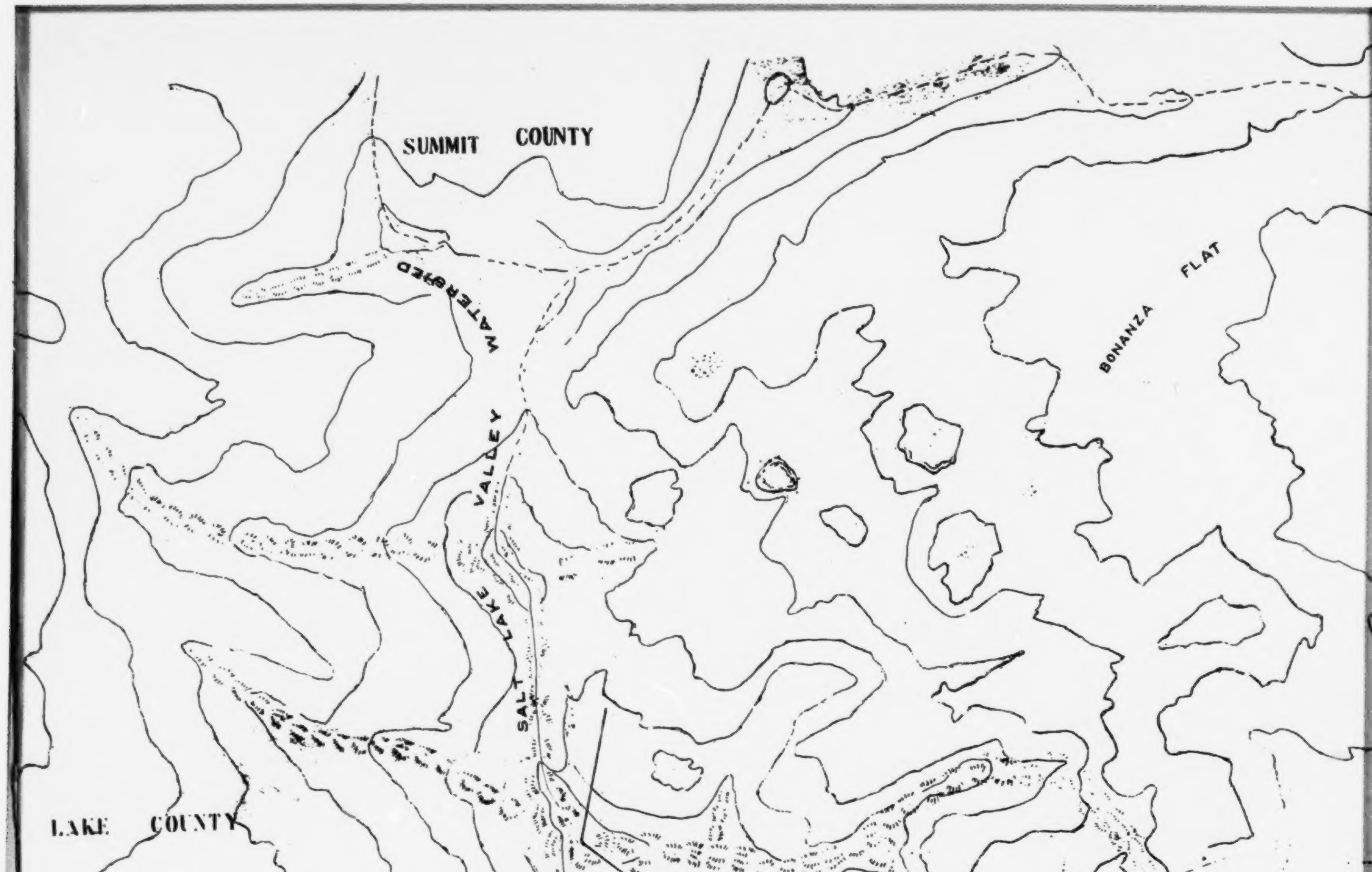
T2S.R.4E
T3S.R.4E

302

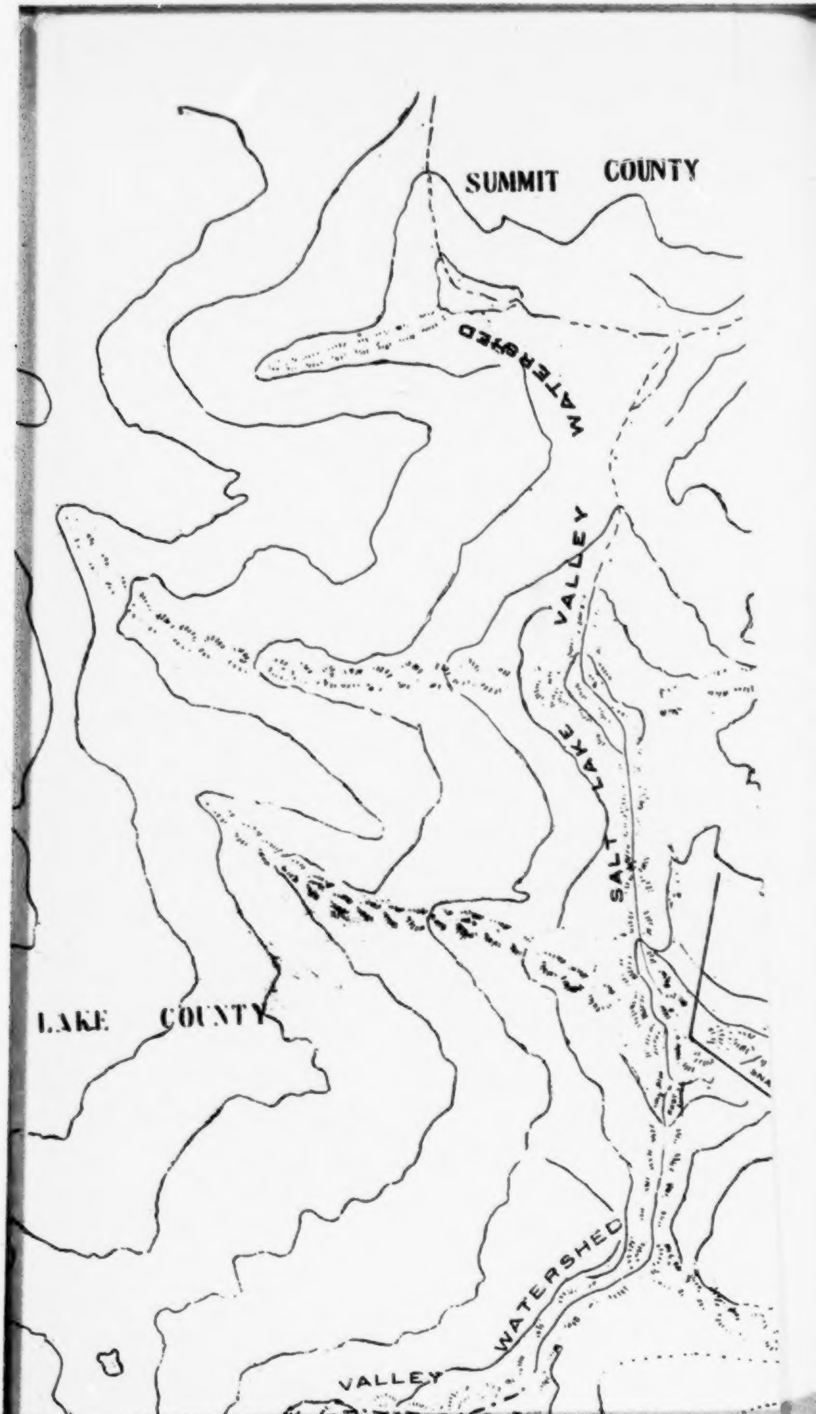
Snake Creek Mining Co. v Midway Irrigation Co

p469

Plaintiff's Exhibit No 139



SUMMIT COUNTY
WATERSHED
BONANZA FLAT
VALLEY
LAKE
SALT
LAKE COUNTY
SNAKE CREEK TUNNEL
WATERSHED
VALLEY


SUMMIT COUNTY
WATERSHED
VALLEY
SALT LAKE
LAKE COUNTY
WATERSHED
VALLEY

(*Appearance of Messrs. Irvine & Thurman as Counsel for the Appellants.*)

United States Circuit Court of Appeals, Eighth Circuit.

No. 5570.

MIDWAY IRRIGATION COMPANY et al., Appellants,

vs.

SNAKE CREEK MINING & TUNNEL COMPANY.

The Clerk will enter my appearance as Counsel for the Appellants.

A. B. IRVINE,
SAM D. THURMAN,
1401 *Walker Bank Building,*
Salt Lake City, Utah.

(Endorsed:) Filed in U. S. Circuit Court of Appeals, Mar. 16, 1920.

(*Appearance of Messrs. Walton & Walton as Counsel for the Appellants.*)

The Clerk will enter my appearance as Counsel for the Appellants.

E. A. WALTON,
T. D. WALTON,
414 *Continental Block,*
Salt Lake City, Utah.

471 (Endorsed:) Filed in U. S. Circuit Court of Appeals, Mar. 17, 1920.

(*Appearance of Messrs. Howat, Marshall, Macmillan & Crow as Counsel for the Appellee.*)

The Clerk will enter my appearance as Counsel for the Appellee.

ANDREW HOWAT,
J. A. MARSHALL,
H. R. MACMILLAN, &
B. S. CROW,
All of Salt Lake City, Utah.

(Endorsed:) Filed in U. S. Circuit Court of Appeals, Aug. 5, 1920.

(Affidavit of George W. Lambourne.)

STATE OF UTAH,
County of Salt Lake, ss:

George W. Lambourne, being duly sworn, on oath deposes and says: That he was secretary, treasurer and general manager of the Snake Creek Mining & Tunnel Company when the tunnel was driven, the ownership of the waters from which is the matter of controversy in the suit of said Snake Creek Mining & Tunnel Company as plaintiff against Midway Irrigation Company and Wilford Van Wagenen, as defendants, in the District Court of the United States for the District of Utah, and which was heard by said court and from the judgment and decree therein the defendants have appealed to this court; that he has been for the ten years last past and is now well acquainted with the value of water for irrigation and other useful purposes at and in the vicinity of said tunnel, and the water issuing from said tunnel was on the 6th day of July, 1914, when said suit was commenced, has ever since continued to be
472 and now is of the actual cash value of more than forty thousand dollars.

GEO. W. LAMBOURNE.

Subscribed and sworn to before me this 4th day of December, 1920.

[SEAL.]

NORMA W. BEST,
Notary Public.

Commission expires Aug. 21, 1924.

(Endorsed:) Filed in U. S. Circuit Court of Appeals, by leave of Court, Dec. 8, 1920.

(Affidavit of O. N. Friendly.)

STATE OF UTAH,
County of Salt Lake, ss:

O. N. Friendly, being duly sworn, on oath deposes and says: That he was chief engineer of the Snake Creek Mining & Tunnel Company when the tunnel was driven, the ownership of the waters from which is the matter of controversy in the suit of said Snake Creek Mining & Tunnel Company as plaintiff against Midway Irrigation Company and Wilford Van Wagenen, as defendants, in the District Court of the United States for the District of Utah, and which was heard by said court and from the judgment and decree therein the defendants have appealed to this court; that he has been for the ten years last past and is now well acquainted with the value of water for irrigation and other useful purposes at and in the vicinity of said tunnel, and the water issuing from said tunnel was on the 6th day of July, 1914, when said suit was commenced, has ever since continued to be and now is of the actual cash
473 value of more than forty thousand dollars.

O. N. FRIENDLY.

Subscribed and sworn to before me this 4th day of December, 1920.

[SEAL.] NORMA W. BEST,
Notary Public.

Commission expires Aug. 21, 1924.

(Endorsed:) Filed in U. S. Circuit Court of Appeals, by leave of Court, Dec. 8, 1920.

(Order of Submission.)

December Term, 1920.

Wednesday, December 8, 1920.

This cause having been called for hearing in its regular order, argument was commenced by Mr. A. B. Irvine for appellants, continued by Mr. H. R. Macmillan for appellee and concluded by Mr. A. B. Irvine for appellants.

Thereupon, this cause was submitted to the Court on the transcript of the record from said District Court and the briefs of counsel filed herein.

474 *(Opinion.)*

United States Circuit Court of Appeals, Eighth Circuit, December Term, A. D. 1920.

No. 5570.

MIDWAY IRRIGATION COMPANY et al., Appellants,

vs.

SNAKE CREEK MINING & TUNNEL COMPANY, Appellee.

Appeal from the District Court of the United States for the District of Utah.

The parties will be referred to herein as they appeared in the court below, the appellants as defendants, and the appellee as the plaintiff.

The plaintiff by its complaint sought to have its claim to the water flowing from its tunnel, between the portal of the tunnel and the point of diversion, less loss by seepage and evaporation, established and confirmed against the defendants; that it be decreed that the defendants have no right to take and divert from Snake Creek below the point where the water, issuing from its tunnel, flows into Snake Creek and the defendants be enjoined from claiming said water or any part thereof. The material allegations in the complaint are that the plaintiff is the owner of a quarter section of land and in April, 1910, it commenced to drive a tunnel, the portal of which is on said land and constructed it 14,500 feet into the

mountain at great depth, and is the owner thereof and the water issuing therefrom; that about 2,684 feet from the portal of the tunnel, water was encountered percolating through the rocks and soil, which is conveyed through and from the tunnel in a sluice at the bottom of the tunnel, the amount of water flowing from the tunnel in 1918 being 14.38 second feet or 6,454 gallons per minute; that from the portal of the tunnel the water flows about 2,000 feet into Snake Creek, which is a tributary of Provo River, both of
which are natural water courses. That water was first encoun-
475 tered in the tunnel in January, 1911, and has been increas-
ing ever since, as the tunnel was lengthened; that in permitting the water from the tunnel to flow into Snake Creek, it did not intend to abandon its title to the water and to become a part of Snake Creek or Provo River, subject to appropriation by others, but claimed to own it with the right to divert it for irrigation or other beneficial purposes. That before the beginning of the irrigation season in 1914 it sold the right to take this water to the Provo Reservoir Company for the purpose of irrigation, which requires it for the growing of crops by its stockholders; that all other waters flowing into Snake Creek, Spring Creek and Provo River had been theretofore appropriated for irrigation and other useful purposes.

That the defendant Irrigation Company is a corporation for the purpose of irrigation and denies that plaintiff is the owner of the water flowing from said tunnel, and claims that it was water subject to appropriation and use by it for its stockholders, and diverts for purposes of irrigation all the water flowing from plaintiff's tunnel into the creek.

That it has diverted the water below where it flows from the tunnel into the creek, and deprived the Provo Reservoir Company and its stockholders of the use of said water, which prevents them from raising crops.

The defendants filed an answer and counter-claim. In it they deny that the water is percolating water in the sense that it is a part of the soil lying therein, but allege that said waters before they enter said tunnel are flowing waters, directly tributary to and part of a natural stream known as Snake Creek, varying at times in proportion as the waters in Snake Creek vary at different times; they deny that Snake Creek and Provo River are public water courses, but allege that long before the plaintiff commenced the driving of the tunnel all the waters of Snake Creek, Spring Creek and Provo River had become vested in private ownership of defendant and its stockholders. They deny that any of the surplus waters in said tunnel were subject to appropriation by the plaintiff or any other person, except the defendants. They claim that
the waters from said tunnel have for more than twenty-five
476 years been appropriated and used by the defendants, who
are now the owners thereof and have the right to use the same for beneficial and useful purposes, no water having been added to the creek or river since the driving of the tunnel; they deny that plaintiff or its predecessors, within twenty-five years before the institution of their action, ever claimed or asserted that the waters

from said tunnel were public waters or subject to appropriation.

In their counter-claim the defendants allege that for more than twenty-five years they and their predecessors in interest have been the owners of all the waters and water rights for irrigation and other beneficial purposes of the waters and water rights for irrigation of Snake Creek, by appropriation and diversion; that the natural sources of said creek consist of rain, melting snow, springs and seepages which, before the construction of the tunnel, ordinarily supplied the greater portion of the flowing water of said creek and were the main reliance of the defendants for the supply of water for the irrigation of their land and other beneficial purposes; that said springs and seepages had their source in the bosom of the mountains and before the construction of the tunnel found their way to the surface of the mountains through natural channels and fissures of the rocks and found their way into said creek and were its natural tributaries and feeders. That all the waters of said creek and water rights pertaining thereto are owned by defendants, and are necessary and not more than sufficient, when economically used, for their purposes as stated. That the plaintiff wrongfully and in violation of defendants' rights drove its tunnel, from the mouth of which a substantial quantity of water flows, sufficient to irrigate several hundred acres of land, which waters formerly found their way into the natural surface channel of Snake Creek through underground channels and sources. That the tunnel is in the immediate vicinity of Snake Creek, its portal being in the canyon through which the creek flows, and in the prosecution of the work undermined, cut off and diverted the underground flowing streams, springs and seepage constituting the permanent source of the flowing water of said creek, and thereby caused said waters to flow into the tunnel. That prior to the digging of plaintiff's tunnel the
477 Mountain Lake Mining Company dug a deep tunnel into
the mounain at a point higher up the stream and higher in elevation than plaintiff's tunnel, which tunnel of the Mountain Lake Mining Company crosses Snake Creek underneath its head. That the driving of the Mountain Lake tunnel dried up some of the springs, which theretofore had come to the surface, and which constituted the head waters of Snake Creek and ever since the waters which formerly came to the surface through said springs thereafter flowed out of the mouth of said Mountain Lake tunnel. That since the driving of plaintiff's tunnel the volume of water flowing out of the Mountain Lake tunnel has receded one third, all of which waters formerly found their way into Snake Creek and supplied the natural volume of flow thereof.

That by constructing its tunnel plaintiff has interfered with the natural supply of the flowing waters of Snake Creek; that before the digging of the tunnel the natural subsurface water supply of said Creek found its way through natural channels into the stream, uniform in volume relatively during the low water season; that since then and by reason thereof the store waters from within the mountain drained off more rapidly and by reason thereof defendants are deprived of water, which otherwise they would have had and so de-

prived during the irrigation season each year, when it is necessary for the maturing of their crops; that if plaintiff is permitted to extend said tunnel further it will still more lessen the water supply, and make the farms and homes of defendants' stockholders valueless. The prayer of the counter-claim is for an injunction, enjoining plaintiff from asserting any claim to the waters flowing from said tunnel and quieting defendants' title to the water flowing from the tunnel and interfering with defendants' free and unrestricted use thereof, and also enjoining it from extending its tunnel further in the mountain.

The reply of the plaintiff to the counter-claim is in effect a general denial of the material allegations alleged.

478 Mr. A. B. Irvine (Mr. Sam D. Thurman was on the brief with him), for appellants.

Mr. H. R. Macmillan (Mr. Andrew Howat, Mr. John A. Marshall and Mr. B. S. Crow were on the brief with him), for appellee.

Before Sanborn and Stone, Circuit Judges, and Trieber, District Judge.

TRIEBER, *District Judge,* after stating the facts as above, delivered the opinion of the Court.

It is admitted by the plaintiff in its brief that the evidence establishes that "the defendants' predecessors in interest had more than twenty-five years before the driving of the tunnel appropriated all of the water flowing in Snake Creek and at some considerable distance below the portal of the tunnel and diverted the water on to their lands for the purpose of irrigation. These lands are arid, and do not bear any crops unless irrigated, and without water were of little or no value."

The learned District Judge reached his conclusion that the owners of the tunnel were entitled to the water which flowed from it, not on the ground that the preponderance of the evidence sustained the plaintiff's claim, but on the ground that notwithstanding the prior appropriation of all the waters of the creek by the Irrigation Company and the fact that the portal of the tunnel was located near the bank of Snake Creek and up towards its sources the burden of proof was on the prior appropriators to show that the waters in the tunnel were derived from subterranean waters which flowed into the creek, if they had not seeped into and been collected with and drawn from the ground by the Tunnel Company by the use of its tunnel.

The Supreme Court of Utah has expressly held: "The burden of proof is upon the one who has discovered certain subterranean water and claiming the same to show that such water is, in fact, 'develeoped water.' Therefore, whoever asserts that he is entitled to the
479 exclusive use of water by reason of his having discovered and 'developed' the same must assure the court, by a preponderance of the evidence, that he is not intercepting the tributaries of the main stream or other body to the waters of which others are entitled." Mountain Lake Mining Co. v. Midway

Irrigation Co., 47 Utah 346, 360. This was reaffirmed in Bastian v. Nebeker, 49 Utah 390. The courts of last resort in other mountain states, where conditions are similar to those prevailing in the State of Utah, have reached the same conclusion. Platte Valley Irrigation Co. v. Buckers I. M. & I. Co., 25 Colo. 77; Smith v. Duff, 39 Mont. 382.

This rule seems more rational and logical than the opposite rule, to-wit: that the burden is upon the prior appropriators to show that subterranean waters drawn by another by means of a tunnel from the ground that might have constituted the sources of the stream, were in fact the source thereof. Those who run tunnels into the mountain and gather water in this way, near the sources of streams, have better means of knowledge whether they are gathering water tributary to the streams than do prior appropriators down the streams, who are cultivating their lands and have nothing to do with the driving of such tunnels, and it would be an irrational and burdensome rule, probably destructive of their rights, to require such prior appropriators to establish the fact in the first instance, that the owners of the tunnel intercepted the tributaries to the stream.

Adopting this rule the evidence warrants findings, and we so find, that since the construction of the tunnel, by the plaintiff, the water in Snake Creek has been materially lessened to an extent that there is not sufficient water in the creek to enable the stockholders of the defendant company to irrigate their lands so as to be able to cultivate their lands, which are all agricultural, unless permitted to use the surplus water flowing into the creek from plaintiff's tunnel; that the water flowing into the creek from that tunnel is not used nor necessary to enable the plaintiff to operate its mine and other works connected with its mining operations, and which under its charter it is authorized to carry on; that the water in controversy is sold by it to another irrigation district formed years after the defendants had appropriated the water in Snake Creek; that
480 the waters of the tunnel are percolating waters and from seep-
age and which before the construction of the tunnel found their way through the soil and rocks to springs flowing into Snake Creek, and had been appropriated and were used by the defendants for irrigating their lands, and that without them their lands cannot be cultivated; that these waters with the water obtained by them from Snake Creek and the Ontario Tunnel, enabled them to raise crops practically every year, but that the plaintiff's tunnel intercepted considerable of this water, thereby diminishing the water in the creek and unless permitted to use the water flowing from the tunnel into the creek, their lands cannot be cultivated. The evidence fails to establish that the water which passes into the tunnel comes from underground channels. The real issue involved, is whether these waters belong to the owner of the soil in which they are found, in this instance the plaintiff, regardless of where they come from. To determine this question, the national courts will follow the rule adopted by the state of the situs, as determined by its court of last resort, if that court has established such a rule.

If it has not been so determined, and in the absence of a controlling statute of the State, it is for the national courts, if called on, to determine what the law is. That the statute of the State, Sec. 2780 Comp. Laws Utah, 1888, cited by counsel for defendants does not apply has been decided in Crescent Min. Co. v. Silver King Min. Co., 17 Utah 444.

The rule which may have prevailed at common law is only material if it has been adopted by the Supreme Court of Utah. As was well said in Starr v. Child, 20 Wend. 159, approved in People ex rel. v. Canal Appraisers, 33 N. Y. 461, and in Katz v. Walkinshaw, 141 Calif. 16: "I think no doctrine better settled than that such portions of the law of England as are not adapted to our condition, form no part of the law of this State. This exception includes not only such laws as are inconsistent with the spirit of our institutions, but such as were framed with special reference to the physical condition of a country differing widely from our own. It is contrary to the spirit of the common law itself, to apply a rule founded on a particular reason, to a law when that reason utterly fails." This principle
481 of law was in effect applied in The Genesee Chief, 53 U. S.
443, when The Thomas Jefferson, 23 U. S. 428, and The Steamboat Orleans, 36 U. S. 175, were, in an opinion delivered by Chief Justice Tamey overruled. In Jennings v. Kirk, 98 U. S. 453, 458, the rules governing water rights, established by miners, which disregarded the common law respecting the rights of riparian owners, were upheld. In Atchison v. Peterson, 87 U. S. 507, quoting from the syllabus, it was held that "on the mineral lands of the public domain in the Pacific States and Territories, the doctrines of the common law, declaratory of the rights of riparian proprietors respecting the use of running waters, are inapplicable or applicable only in a very limited extent to the necessities of miners, and inadequate to their protection; their prior appropriation gives the better right to running waters to the extent, in quantity and quality, necessary to the uses to which the water is applied."

The conditions in the western mountain states, where the lands are practically arid, and therefore agricultural products can only be raised by the aid of irrigation, differ materially from those prevailing in England and, therefore, unless the Supreme Court of Utah has adopted the so-called English rule, we do not deem it a proper rule to be applied in that State. It has been so held by the courts of the states where similar conditions prevail as in the State of Utah. Katz v. Walkinshaw, 141 Calif. 116; McClintock v. Hudson, 141 Calif. 275; Los Angeles v. Hunter, 156 Calif. 603; Comstock v. Ramsey, 55 Colo. 244, 133 Pac. 1107; Wiel on Water Rights (3rd Ed.) sections 1063 and 1066; 2 Kinney on Water Rights, Sections 1193, 1194.

The rule generally adopted by, not only the courts of the arid states, but by most of the American courts, so that it may be said to be the American, as distinguished from the English rule, is that, while the owner of the land is entitled to appropriate subterranean or other waters accumulating on his land, which thereby become a part of the realty, he cannot extract and appropriate them in excess of a reasonable and beneficial use upon the land he owns, uncon-

nected with the beneficial use of the land, especially if the exercise of such use in excess of the reasonable and beneficial use is injurious to others, who have substantial rights to the water. Meeker v. City of East Orange, 77 N. J. L. 723; Smith v. Brooklyn,
482 18 N. Y. App. Div. 340, aff. 160 N. Y. 359; Tarbell v. New
York, 164 N. Y. 522; Burnett v. Salisbury, 43 N. H. 569; Willis v. Perry, 92 Ia. 297; Stillwater Water Co. v. Farmer, 89 Minn. 58.

The rulings of the Supreme Court of Utah are not harmonious. The earliest decisions seem to have favored the English rule, although they were not always harmonious. But in its latest decisions that court has adopted the American rule, although not so stated in express terms, and in effect overruling Roberts vs. Gribble, 43 Utah 411, a case much relied on by counsel for plaintiff.

If there be any inconsistency in the opinions of the court of last resort of a state in determining a rule of law, which the national courts are bound to follow, the general rule is that they will follow the latest settled adjudication in preference to the earlier ones. United States v. Morrison, 29 U. S. 6; Green v. Neal's Lessee, 31 U. S. 291; Wade v. Travis County, 174 U. S. 499, 508; Leffingwell v. Warren, 67 U. S. 599; Quinette v. Pullman Co., 229 Fed. 333, 143 C. C. A. 453; Kibbe v. Ditto, 93 U. S. 674; Bauserman v. Blunt, 147 U. S. 647. The exception to this rule is, where, upon the faith of state decisions, contracts or investments have been made on the faith of these decisions, and which at the time had not been overruled. But in the instant case plaintiff constructed its tunnel for mining only, and not to obtain water to sell for irrigation purposes. It therefore cannot be said that it made its investment for the purpose of using the surplus waters for the purpose of sale. For this reason the authorities cited by counsel, based upon the rule of law applied in Gelpcke v. Dubuque, 68 U. S. 175, Burgess v. Seligman, 107 U. S. 20 and other cases cited, which are to the same effect, is inapplicable and does not sustain, the contention that this court must follow the rulings of the Supreme Court of Utah made prior to and not overruled at the time the plaintiff constructed its tunnel.

It will serve no useful purpose to review the older opinions of that court, as they have been considered by the Supreme Court of Utah in its latest decisions, which we deem it our duty to follow.

In Stookey v. Green, 178 Pac. 586, opinion filed Jan. 27, 1919, that court, referring to Garns v. Rollins, 41 Utah 260, and Roberts v. Gribble, supra, said: "In Garns v. Rollins * * * it was
483 held that the run-off, waste and seepage from irrigation are
not subject to appropriation as against the owner of the land irrigated who desires to recapture it and apply it on his own land.

"In Roberts v. Gribble * * * the water in dispute resulted mainly from the irrigation of lands in the vicinity. Defendant's land became swampy. He put in a drain system, collected the water, and used it upon his own land. In doing so he deprived plaintiff of its use."

The court then said: "The principle underlying these two cases seems to be that waste and seepage waters from artificial irrigation,

constitute an artificial, rather than a natural, source of supply, and therefore are not the subject of appropriation. This principle is undoubtedly correct as applied to the facts in the Garns case, and the Roberts v. Gribble case relies on the Garns case as authority. If it goes no farther we are of the opinion it rests upon a firm foundation." In Rasmussen v. Maroni Irrigation Co., 189 Pac. 572, the previous decisions of the court were relied on by appellant. The court, referring to Stookey v. Green, supra, said: "All of the foregoing decisions, except the two in which the Herriman Irrigation Company was a party, are considered and reviewed in the recent case of Stookey v. Green. The legal effect of those decisions and the principles upon which they rest are so clearly and ably stated by Mr. Justice Thurman that it would be a work of supererogation on the part of the writen to attempt to further review and statement."

The court in referring to Roberts v. Gribble says: "The only case in which it might be said that the facts and conditions somewhat resemble those of the case at bar is the case of Roberts v. Gribble, supra. The decision in that case is, however, squarely based upon the case of Garns v. Rollins, and the facts in the latter case necessarily take the Roberts decision entirely outside of the principles which must control the case at bar. If, however, the case of Roberts v. Gribble, shall be construed so as to make it applicable to the undisputed facts of the case at bar, then the decision in that case must be distinguished and if necessary modified so as to limit the same to the facts in the case of Garns v. Rollins, which is the sole basis of the decision of the Roberts v. Gribble case." The court then adopts as the correct principle the rule found in 2 Kinney Irr.
484 and Water Rights, sections 1193 and 1194, which is quoted in full and reproduced here:

"It was not until the more recent scientific investigations, before mentioned, as to the movements of underground waters through the soil, that these percolating waters tributary to surface waters were recognized as belonging to any particular class, or that any rights could be acquired in them other than the rights which could be acquired to the soil itself, through which they found their way, of which soil, under the prevailing common law rule, they were considered component parts. But, by these geological and topographical investigations made by the government and others, it has been proven in many instances that waters percolating through the soil of watersheds were not only the sources of supply, but the only source of supply of certain streams and other surface bodies of water. It being proven absolutely that these percolating waters physically are directly tributary to these streams, the law has kept pace with these scientific investigations proving this fact; and therefore it follows that in law they should be, and in many jurisdictions are, dealt with and treated as tributary waters. And, where rights to the waters of the stream itself have been once acquired, by appropriation or otherwise, it is unlawful for persons owning land bordering on the stream to intercept the waters percolating through them on their way to the stream, and apply it to any use other than its reasonable use upon the land

upon which it is taken, if he thereby diminishes the flow of the stream to the damage of those having rights therein. Therefore this rule modifies the common-law rule that the owner of the land is also the owner of all the water found percolating as a part of the soil itself, and that he may use and dispose of it as he sees fit, to the extent that he may only use these waters so percolating through his land, subject: First, to the rights of others to the water flowing in the stream which this water augments, upon the same principle as though this water was a part of the stream itself. * * *"

In the concluding part of the opinion the court said:

"The fact that the water in question may be percolating or seepage, as contradistinguished from the water flowing in known and
485 defined underground channels, does not alter the case. The controlling question always is: *Was the water in question appropriated and put to beneficial use by others before the inception and attempted appropriation thereof by the landowner?*" (The italics are ours.) See also McClintock v. Hudson, 141 Calif. 275, a tunnel case in which the facts are much like those in the instant case. In this connection it is proper to state that these two opinions were rendered after the decision in this case was filed in the court below.

The water in controversy is unconnected with plaintiff's use of the tunnel, in fact is not used for the plaintiff's own use, its business being mining and not farming, and therefore it cannot be said that selling it is a reasonable, or so far as its business is affected, a beneficial use. See Mr. Justice Baskin's concurring opinion in Herriman Irr. Co. v. Keel, 25 Utah, 96, 124, on that point. To sell it to other irrigation companies cannot be said to be a reasonable and beneficial use for its business, when the effect of it is, as the evidence in the case at bar clearly establishes that, it is destructive of defendants' rights to use the water of Snake Creek, which they had, twenty-five years before the driving of the tunnel by the plaintiff, appropriated, and without it their lands would become absolutely valueless.

The decree in favor of the plaintiff must be reversed and a decree entered dismissing its complaint. On the counterclaim, defendants are entitled to an injunction enjoining plaintiff from asserting any claim to the surplus waters, flowing from the portals of the mine into Snake Creek, not wanted for operating its mines, and quieting defendants' title thereto. The prayer for an injunction enjoining the plaintiff from extending its tunnel further in the mountain will be denied.

Filed January 28, 1921.

486 (*Decree.*)

United States Circuit Court of Appeals, Eighth Circuit, December Term, 1920.

Friday, January 28, 1921.

No. 5570.

MIDWAY IRRIGATION COMPANY and WILFORD VAN WAGENEN, Appellants,

vs.

SNAKE CREEK MINING AND TUNNEL COMPANY.

Appeal from the District Court of the United States for the District of Utah.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the District of Utah, and was argued by counsel.

On consideration whereof, it is now here ordered, adjudged and decreed by this Court, that the decree of the said District Court, in this cause, be, and the same is hereby, reversed with costs; and that the Midway Irrigation Company and Wilford Van Wagenen have and recover against the Snake Creek Mining and Tunnel Company the sum of — Dollars for their costs in this behalf expended and have execution therefor.

It is further ordered that this cause be, and the same is hereby, remanded to the said District Court with directions to enter a decree dismissing the complaint and on the counterclaim enjoining plaintiff from asserting any claim to the surplus waters, flowing from the portals of the mine into Snake Creek, not wanted for operating defendants' mines, and quieting defendants' title thereto; and further denying the prayer for an injunction enjoining the plaintiff from extending its tunnel further in the mountain.

January 28, 1921.

487 (*Clerk's Certificate.*)

United States Circuit Court of Appeals, Eighth Circuit.

I, E. E. Koch, Clerk of the United States Circuit Court of Appeals for the Eighth Circuit, do hereby certify that the foregoing contains the transcript of the record from the District Court of the United States for the District of Utah as prepared and printed, pursuant to the designation of appellants and the stipulation of the parties, under the rules of the United States Circuit Court of Appeals for the Eighth Circuit, under the supervision of its Clerk, and full, true and complete copies of all the pleadings, record entries and proceedings, including the opinion, had and filed in the United States Circuit Court

of Appeals, except the full captions, titles and endorsements omitted in pursuance of the rules of the Supreme Court of the United States, in a certain cause in said Circuit Court of Appeals wherein Midway Irrigation Company, et al., were Appellants, and Snake Creek Mining and Tunnel Company was Appellee, No. 5570, as full, true and complete as the originals of the same remain on file and of record in my office.

In testimony whereof, I hereunto subscribe my name and affix the seal of the United States Circuit Court of Appeals for the Eighth Circuit, at office in the City of St. Louis, Missouri, this twenty-third day of February, A. D. 1921.

[Seal of the United States Circuit Court of Appeals, Eighth Circuit.]

E. E. KOCH,
Clerk of the United States Circuit Court of Appeals for the Eighth Circuit.

488 In the United States Circuit Court of Appeals for the Eighth Circuit.

No. 5570.

MIDWAY IRRIGATION COMPANY et al., Appellants,

vs.

SNAKE CREEK MINING & TUNNEL COMPANY, Appellee.

Stipulation.

Whereas on the petition of the Snake Creek Mining and Tunnel Company, appellee in the above entitled cause, filed in the Supreme Court of the United States, said last named Court has duly issued its Writ of Certiorari commanding that the record and proceedings in said cause be sent to said Court without delay; and

Whereas, accompanying said petition for said writ there has already been filed in said Supreme Court by the petitioner a duly certified copy and transcript of said record and proceedings;

Now, therefore, it is hereby stipulated by the attorneys for all of the parties to said suit, both appellants and appellee, that said certified transcript of record already on file in said Supreme Court shall be taken as a return to the said writ and that the Clerk of said Circuit Court of Appeals transmit forthwith to said Supreme Court a certified copy of this stipulation as a return to said writ.

Dated May 16th, 1921.

A. B. IRVINE,
SAM D. THURMAN,
Attorneys for Appellant-.
H. L. MACMILLAN,
Attorney for Appellee.

(Endorsed:) U. S. Circuit Court of Appeals, Eighth Circuit. No. 5570. Midway Irrigation Company et al., Appellants, vs. Snake Creek Mining & Tunnel Company. Stipulation as to return to writ of certiorari. Filed May 19, 1921, E. E. Koch, clerk.

489 UNITED STATES OF AMERICA, *ss:*

[Seal of the Supreme Court of the United States.]

The President of the United States of America to the Honorable the Judges of the United States Circuit Court of Appeals for the Eighth Circuit, Greeting:

Being informed that there is now pending before you a suit in which Midway Irrigation Company et al. are appellants, and Snake Creek Mining and Tunnel Company is appellee, No. 5570, which suit was removed into the said Circuit Court of Appeals by virtue of an appeal from the District Court of the United States for the District of Utah, and we, being willing for certain reasons that the said cause and the record and proceedings therein should be certified by the said Circuit Court of Appeals and removed into the Supreme Court of the United States, Do hereby command you that you send
490 without delay to the said Supreme Court, as aforesaid, the record and proceedings in said cause, so that the said Supreme Court may act thereon as of right and according to law ought to be done.

Witness the Honorable Edward D. White, Chief Justice of the United States, the fifth day of May, in the year of our Lord one thousand nine hundred and twenty-one.

JAMES D. MAHER,
Clerk of the Supreme Court of the United States.

491 [Endorsed:] File No. 28,237. Supreme Court of the United States, October Term, 1920. No. 880. Snake Creek Mining and Tunnel Company vs. Midway Irrigation Company et al. Writ of Certiorari. Filed May 19, 1921. E. E. Koch, clerk.

Return to Writ.

UNITED STATES OF AMERICA,
Eighth Circuit, ss:

In obedience to the command of the within writ of certiorari and in pursuance of the stipulation of the parties, a full, true and complete copy of which is hereto attached, I hereby certify that the transcript of record furnished with the application for a writ of certiorari in the case of Midway Irrigation Company et al., Appellants, v. Snake Creek Mining & Tunnel Company, No. 5570, is a full, true and complete transcript of all the pleadings, proceedings and record entries in said cause as mentioned in the certificate thereto.

In testimony whereof, I hereunto subscribe my name and affix the

seal of the United States Circuit Court of Appeals for the Eighth Circuit, at office in the City of St. Louis, Missouri, this nineteenth day of May, A. D. 1921.

[Seal of United States Circuit Court of Appeals Eighth Circuit.]

E. E. KOCH,
Clerk U. S. Circuit Court of Appeals for the Eighth Circuit.
F.

492 [Endorsed:] File No. 28,237. Supreme Court U. S., October Term, 1920. Term No. 302. Snake Creek Mining & Tunnel Co., Petitioner, vs. Midway Irrigation Co. et al. Writ of certiorari and return. Filed May 21, 1921.